A STUDY ON NURSES' KNOWLEDGE, ATTITUDE AND PRACTICES OF INFECTION PREVENTION AND CONTROL AT A PRIVATE HOSPITAL IN NAMIBIA

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Declaration

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Abstract

Background: Healthcare-associated infections (nosocomial) are one of the leading adverse events within the healthcare sector worldwide. They are linked to an increasing number of morbidities and mortalities, an increased length of hospital stay and subsequent physiological, psychological and financial burden on the patient, their family, and the healthcare facility. In order to reduce these rates, consistent compliance with an effective infection prevention and control (IPC) programme is vital. It is for this reason that the purpose of this study was to determine nurses' knowledge, attitude and IPC practices as these influence compliance of the IPC programme.

Methods: A quantitative descriptive study was conducted in a Namibian private hospital. The target population (n=122) included all categories of nurses. Non-probability convenient sampling was done to ensure that all the nurses who were on duty during the data collection period were given opportunity to participate in the study. Data were collected from n = 90 (86%) of the target population. The data instrument was a questionnaire, which was adopted from a similar study in Nepal. A pilot test was conducted to determine the reliability and validity of the questionnaire. Ethical approval was obtained from the University of Stellenbosch's healthcare research ethics committee, and the private hospital's clinical research ethics committee.

Results: The majority n=72 (80 %) of participants had adequate knowledge of IPC; n=76 (84.4%) had a positive attitude towards IPC and n=36 (40%) complied with the IPC practice. With regards to the relationship between the level of knowledge, attitude and infection prevention and control practices: of the participants (n= 72, 80%) with adequate knowledge, (n=7, 9.7%) have a significant negative attitude towards IPC (p = 0.002) and (n=38, 52.8%) are non-compliant with IPC practices (p=0.005) as well as participants with a positive attitude (n=76, 84.4%), (n=46, 60. 5%) are non-compliant with IPC practices (p=0.364, no relationship).

Conclusion: The participants (nurses) had adequate knowledge and a positive attitude towards IPC. However, efforts should focus on improving their compliance of the IPC practice. It is recommended that IPC training should focus on information sharing, as well as on psychological motivation, in order to lead to a change in IPC behaviour.

Keywords: nurses, knowledge, attitude, practice, infection prevention and control

Opsomming

Agtergrond: Gesondheidsorg se geassosieerde infeksies (GGIs) is wêreldwyd een van die voorste ongunstige gebeure binne die gesondheidsorgsektor. Dit word gekoppel aan ‘n toenemende aantal gevalle van morbiditeit en mortaliteit, ‘n toename in die lengte van hospitaalverblyf en gevolglike fisiologiese, psigologiese en finansiële las op die pasiënt, die familie en die gesondheidsorg fasiliteit. Ten einde die koers te verlaag, is volgehoue nakoming van ‘n effektiewe infeksie voorkoming en beheer (IVB)-program belangrik. Dit is om hierdie rede dat die navorser hierdie navorsingstudie onderneem het, om die verpleegsters se kennis, gesindheid en IVB praktyke te bepaal, want dit het ‘n invloed op die nakoming van IVB program.

Metode: ‘n Kwantitatiewe, beskrywende studie is in ‘n privaathospitaal in Namibië gedoen. Die teikenbevolking het al die kategorieë van verpleegsters, N = 122 ingesluit. ‘n Onwaarskynlikgerieflikheidssteekproef is gedoen om te verseker dat al die verpleegsters ‘n gelyke geleentheid gebied word om aan die studie deel te neem. Data is gekollekteer van n = 90 (86%) van die teikenbevolking. Die instrument wat gebruik is vir data-insameling is van ‘n soortgelyke studie nagevolg wat in Nepal gedoen is. ‘n Loodstudie is gedoen om die betroubaarheid en geldigheid van die vraelys vas te stel. Etiese goedkeuring is van die Universiteit van Stellenbosch se Gesondheidsnavorsing Etiekkomitee (Verwysingsnommer: S17/08/152), en van die privaathospitaal se Kliniese Navorsingsetiekkomitee verkry.

Resultate: Die meerderheid n = 72 (80%) van die deelnemers het voldoende kennis van IVB; n = 76 (84.4%) het 'n positiewe houding teenoor IVB en n = 36 (40%) het aan die IVB-praktyk voldoen. Wat die verband tussen die kennis-, houding- en infeksievoorkomings- en -beheerpraktyke betref: van die deelnemers (n = 72, 80%) met voldoende kennis, (n = 7, 9,7%) het 'n beduidende negatiewe gesindheid teenoor IVB (p = 0,002) en (n = 38, 52,8%) voldoen nie aan IVB-praktyke nie (p=0.005) sowel as deelnemers met 'n positiewe houding (n = 76, 84,4%), (n = 46, 60. 5%) voldoen nie aan IVB-praktyke nie (p = 0.364, geen verhouding).

Slotsom: Na aanleiding van die resultate het die verpleegsters genoegsame kennis en ‘n positiewe houding oor IVB. Desnieteenstaande die pogings, behoort die fokus op die verbetering van die nakoming ten opsigte van die IVB praktyk te wees. Daar word dus aanbeveel dat IVB-opleiding nie alleenlik op die verspreiding van inligting

moet wees nie, maar ook op psigologiese motivering wat sal lei tot gedragsverandering.

Sleutelwoorde: Verpleegsters, kennis, houding, praktyk, infeksie-voorkoming en -beheer

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Abbreviations

HAI	Healthcare-associated infection
IPC	Infection prevention and control
BCA	Best Care Always!
ENA	Enrolled nurse auxiliary
EN	Enrolled nurse
WHO	World Health Organisation
KAP	Knowledge, attitude and practices

CHAPTER 1

FOUNDATION OF THE STUDY

1.1 Introduction

An increasing number of patients worldwide are affected by healthcare-associated infections (HAIs) each year which leads to a significant increase in mortality rate as well as a financial loss for healthcare systems (WHO, 2010:n.p). HAIs are therefore recognised as the most prevalent adverse events and the number one cause of morbidity and mortality within a hospital environment (Yamakawa, Takasi, Fukuyama, Kitayama, Matsuda & Nakamori, 2011:1). The prevalence of HAIs compromises the quality of patient care and safety; a need for compliance with infection prevention and control (IPC) programme is mandatory (WHO 2016:1).

According to the WHO, HAIs are defined as those infections, which patients acquire in hospitals or other healthcare facilities during the process of care, that were not present or incubating at the time of admission, these include occupational infections amongst the staff (WHO-healthcare associated infections fact sheet, 2010:n.p). These include infections, which occur 48 hours after admission, those that occur during the process of care when a patient was admitted for reasons other than the infections, as well as an infection that occurs within three days after a patient has been discharged from the hospital or 30 days after surgical procedures were done (Stubblefield & Krucik 2014:1).

In order to reduce or eliminate the prevalence of HAIs, various healthcare facilities have put measures in place. This includes establishing an IPC programme, which directly targets preventing and controlling infections with a healthcare facility. For a IPC programme to effectively prevent and control the transmission of infections, means that

there must be a high compliance by healthcare staff (Darawad & Al-Hussami, 2013:581). Data tracking at the facility report indicates that HAI is more than 2, 05 per 1000 bed days, which is more than the target of 0.95 per 1000 bed days. The report furthermore indicates that more than 30% of the patients admitted contracted at least one HAI; surgical site infections being the most prevalent at 36% of all HAIs (Private Hospital's IPC Report 2018: n.p). Various studies concluded that compliance with an IPC programme is directly linked to healthcare workers' knowledge, attitude and their IPC practices (Liu, Song, Wang, Kang, et al., 2013:834; Darawad & Al-Hussami, 2013:582 and Ojulong et al., 2013:1071).

In this setting, according to the IPC annual report of 2017/2018, compliance with the IPC programme remained consistently low, especially with regard to hand hygiene and Best Care Always bundles (Private Hospital's IPC Report 2018: n.p). It is against this background that the researcher conducted this study to determine the reason for this low compliance. The study focused on determining nurses' knowledge, attitude and IPC practices, as these variables influence the level of compliance with the IPC programme.

1.2 Significance of the problem

At any given time, HAIs amongst hospitalised patients range between 3.5% - 12% in developed countries and 5.7 % - 19.1 % in developing countries (WHO 2011:12). Most of these infections occur in an intensive care unit (ICU) where as many as 51% of ICU patients will acquire at least one HAI (WHO 2011:12). There is limited data on HAIs prevalence rates in developing countries; more than 60% of developing countries worldwide have no published data on the burden of HAIs (Rothe, Schlaich, & Thompson, 2013:257). Furthermore, only 15.6% of developing countries reported having an active surveillance system (WHO 2011:12).

The situation is no different in sub-Saharan Africa (SSA), available data indicate that pneumonia (hospital acquired or ventilator-associated) was identified to be the most frequent HAI, followed by surgical site infection (Rothe *et al.*, 2013:259). Surgical site

infections (SSIs) were estimated to occur in 6.8 – 26 % of all surgical patients in SSA, which is lower than SSI prevalence of 29.1% in Europe (Rothe *et al.*, 2013:258).
The Centre for Disease Control (CDC) reported pneumonia and SSI to be the most common HAI: 21.8%, respectively, followed by gastro-intestinal tract (GIT) infections at 17.1%. In addition, *Clostridium difficile* was identified as the most prevalent pathogen and was responsible for 12.1% of all HAIs (also known as nosocomial infections) and 70.9% of GIT infections, followed by methicillin-resistant *Staphylococcus aureus* (MRSA) (10.7%); *Klebsiella* pneumonia and *Klebsiella oxytoca* (9.9%) and *Escherichia coli* (9.3%) (Hand, 2014:1198-1208).

There is no available literature for Namibia due to lack of HAIs surveillance in most of the healthcare facilities. However, the private hospital, which was the site of this study, has an active HAIs surveillance system in place and identified SSI as the most prevalent HAIs with MRSA being the leading disease-causing pathogen (Private Hospital's IPC Report 2018: n.p).

This high HAIs prevalence rate could have devastating consequences for both patients and the country as a whole. Healthcare associated infections can increase morbidity and mortality rates, as well as the length of hospital stay, placing an increased demand on the resources of health facilities (Roley & Trustcott 2013:2). In addition, these infections increase the workload of the nurses; they spend the greatest time at patients' bedsides hence the quality of patient care rendered may be compromised (Dempsey, Reilly & Buhlmann, 2014:142). HAIs are listed amongst the leading adverse events associated with medical negligence (Jha, Larizgoitia, Audera-Lopez, Prosopa-Plaizier, Waters & Bates 2013:810). As a result, this can have legal and financial implications for a healthcare facility.

In an effort to reduce HAIs prevalence, the private hospital in this study established an IPC programme, which adopted evidence-based initiatives from the WHO and the Best Care Always! (BCA) campaigns (Private Hospital's IPC Report 2018:n.p). Compliance is however vital for the programme to be effective in preventing and controling the

transmission of HAIs (Jeong *et al*., 2013:712). The infection control report of the hospital in this study indicated poor compliance with the IPC programme, resulting in high HAIs prevalence rates (Private Hospital's IPC Report 2018:n.p). It is for this reason, that the researcher undertook this study to determine the factors associated with poor compliance.

1.3 Rationale

Researchers have suggested that compliance with an IPC programme is highly influenced by healthcare workers' level of knowledge ,attitude and practice towards the programme (Liu, Song, Wang, Kang, *et al.*, 2013:834; Darawad & Al-Hussami, 2013:582 and Ojulong *et al.*, 2013:1071). Therefore, in order to measure the effectiveness of an IPC programme, an 80 % compliance is mandatory (Darawad & Al-Hussami 2013:582).

Audit of the hospital in this study reported that there was a 60 % compliance with the 'Five Moments of Hand Hygiene' programme (Private Hospital's IPC reports 2018:n.p). In order to work towards achieving an 80% compliance rate with the elements of the IPC programme, it was deemed necessary to establish the nurses' knowledge and attitude towards IPC and to determine whether their IPC practices are compliant or non-compliant in terms of the programme at the healthcare facility in this study.

Literature studies show that an increase in compliance is directly linked to nurses having adequate knowledge of an IPC programme (Darawad & Al-Hussami, 2013:581). Knowledge levels influence IPC programme compliance thus low knowledge resulted in the high reported HAIs prevalence rates in developing countries.

Garland (2013:140) reported that healthcare professionals in developed countries have adequate knowledge of IPC programmes. This was also the case as reported by Hand (2014:n.p), since an increased compliance resulted in a low HAIs prevalence rate in developed countries. Conversely a study in a developed country found nurses' knowledge of IPC to be inadequate despite low HAIs prevalence in developed countries (Bergamini, Cucchi, Stefanati, Cavallaro & Gabutti 2009:100). The adequate knowledge theory, in

terms of low compliance, is supported in the literature (Darawad & Al-Hussami, 2013:581; Alkubati, Ahmed, Mohammed, Fayed & Asfour, 2015:27). Idler, Adams, Morton, Whitby and Clements (2012:170), in their studies conducted in developing countries, also reported that healthcare workers' knowledge was inadequate in terms of programme for IPC, thus there was subsequently high HAIs rates. Generally, in developing countries when compared to other healthcare professionals, nurses scored significantly lower, suggesting their knowledge of IPC was inadequate (Hamadah Kharaz, Alshangity, Al-Famoz, Eshaq & Abu-Zaid, 2015:315; Asadpour *et al.*, 2015:103).

In other words the reduction of the rate of HAIs does not depend on knowledge alone to improve healthcare workers' compliance in terms of the programme for IPC (Hamishecker, Vahidinezhad, Mashayeskhi, Asgharian, Hassankhani & Mahmoodpoor 2014:51). In addition to knowledge, the attitude of healthcare workers plays a major role in influencing their IPC practice compliance.

There is a significant difference in nurses' attitude toward the IPC programme. The younger, less experienced healthcare workers seem to be more enthusiastic about these programmes and are eager to comply; the more experienced nurses perceive them as an added workload burden rather than an integral part rendering quality patient care (Ward 2012:302). Furthermore, according to Jansson *et al.*, 2013:216), even though more experienced healthcare workers were reported to have adequate knowledge, their attitude towards the IPC programmes was poor compared to their younger colleagues who were new to the profession. This rebellious attitude was fostered by resistance to change and to adapt to new evidence-based practices. The danger is that the more experienced workers are the mentors and this negative attitude can be easily instilled into the younger upcoming nurses. As a result, this could give rise to a generation of young nurses who resist change, and this would have a negative impact on quality care and patient safety.

In order to keep up with current trends in the field, healthcare workers need to keep abreast with the latest development in the profession, so that they do not stagnant in their

old habits. Once there is a change in attitude, these should significantly influence their compliance with the IPC programmes (Garland 2013:149).

Garland (2013:149) further reported that nurses do not adequately practice safe infection control measures and this might be influenced by their attitude towards IPC. Darawad and Al-Hussami (2013:582), hold a similar opinion as they reported that infection control practices of nurses are inadequate in preventing HAIs. The researcher works in the private hospital in this study and observed that healthcare workers do not always perform hand hygiene between patients or wear disposable gloves when required to. As such, healthcare workers do not always observe infection control practices when conducting aseptic procedures.

It is against this background that the researcher conducted this study with the assistance of a competent fieldworker to investigate nurses' knowledge, attitude and practices of IPC in terms of influencing their compliance of the IPC programme.

1.4 Problem statement

HAIs are a major problem at a private hospital in Namibia. Data tracking HAIs show that the HAIs rate is currently 2.05 per 1000 bed days. This is markedly higher than the target of 0.92 per 1000 bed days. The majority of these reported HAIs were in the ICU and NICU; between 20 – 35 % of patients were reported to have at least one HAI. Surgical site infections were the most prevalent constituting 35.7% of all infections (Private Hospital's IPC reports 2018:n.p).

The report further indicated that compliance with hand hygiene was on average 60% (2018:n.p). In addition, compliance with the othe
r elements of the IPC programme was observed to be poor. It is for this reason that this study covered factors that influenced this non-compliance.

1.5 Research question

What are the nurses' knowledge, attitude and practices of infection prevention and control at a private hospital in Namibia?

1.6 Research aim

The aim of the study was to investigate nurses' knowledge, attitude and practices of infection prevention and control to determine how these relate to the low compliance with the IPC programme at a private hospital in Namibia.

1.7 Research objectives

The research objectives set for this study were:

- To explore nurses' knowledge of infection prevention and control at a private hospital in Namibia.
- To describe nurses' attitudes towards the IPC at a private hospital in Namibia.
- To determine the infection control practices of nurses at a private hospital in Namibia.
- To describe the relationship between the level of knowledge, attitude and infection prevention and control practices at a private hospital in Namibia.

1.8 Conceptual framework

Various researchers maintain that the reduction of HAIs is possible. However, this is dependent on the extent to which the healthcare workers comply with the IPC programme (Darawad & Al-Hussami, 2013:582). To achieve this, a compliance rate of 80% or more, adequate knowledge and a positive attitude towards IPC is essential (Hamishecker *et al.*, 2014:51; Ward, 2012:302).

The study conceptualises the problem by assuming that nurses' knowledge, attitude, and practices' (KAP) factors are independent variables. IPC compliance is the dependent variable. The illustration in Figure 1.1 is an indication of the relationship between these variables. To increase compliance to the IPC programme, nurses require adequate knowledge, positive attitudes and compliant to the IPC practices, as inadequate

knowledge affects the extent to which they comply with the IPC programme (Garland, 2013:149).

In order to comply with the IPC programme, it is vital that the nurses have adequate knowledge (Garland, 2013:149). However, knowledge alone is not enough to improve compliance because nurses need to have a positive attitude towards practices that comply with the IPC programme (Jansson *et al.*, 2013:216).

Attitude: The conceptual framework include the theory of planned behaviour by Icek Ajzen. Theorists indicate that attitude on its own does not influence behaviour. However, it can be used to predict intent when it is combined with perceived control and norms. An attitude towards a behaviour can be negative or positive, based on a person's beliefs about the consequences of their actions. Perceived control of a behaviour indicates the level of hardship with which such a behaviour can be executed. The third basis for the planned behaviour theory is the subjective norm; this is how a behaviour is socially accepted (McGaw, Tennant, Harding, Cawich, Crandon & Walters, 2012:6). Adequate knowledge of an IPC programme, and a positive attitude toward the programme , would in turn influence the nurses IPC pracitces, which should lead to an increase in compliance with the IPC programme. This in turn would lead to a reduction and elimination of HAIs. Figure 1.1 shows the conceptual map of planned behavour theory.

Furthermore, in order to ensure this, the nurses' practice should consistently comply with the IPC programme (Hussen *et al.,* 2017: 6). On the other hand, with non-compliance, the IPC programme will be ineffective and as a result HAIs will persist.

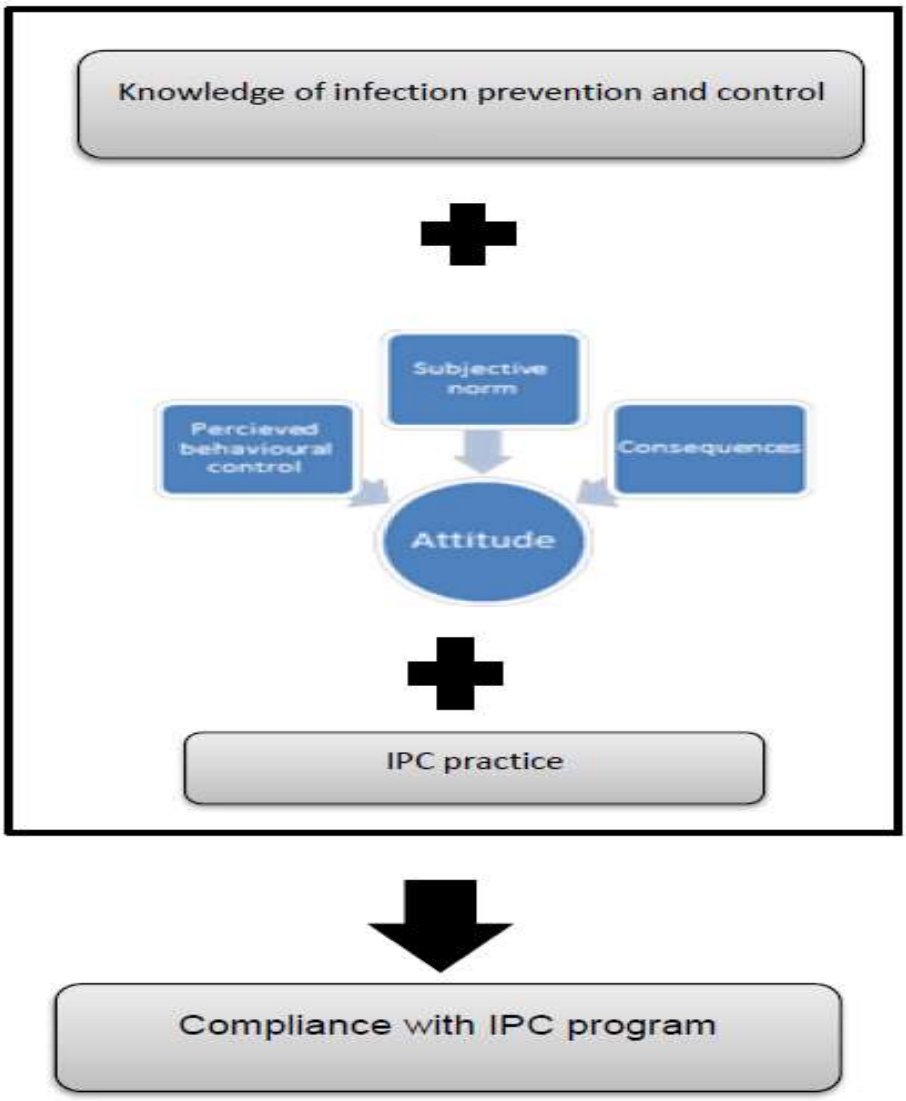


Figure 1.1: The conceptual map for knowledge, attitude and practices of infection prevention and control in relation to compliance with an IPC programme; it includes the planned behaviour theory (McGaw, Tennant, Harding, Cawich, Crandon and Walters (2012) related to attitude.

1.9 Research methodology

1.9.1 Research design

A quantitative approach with a descriptive correlation design was chosen for this research study.

1.9.2 Study setting

The study was conducted at a private hospital in Windhoek, Namibia.

1.9.3 Population and sampling

The study was conducted amongst all categories of nurses working at the private hospital (n=122). Convenient sampling was used; all the nurses who met the selection criteria, and were on duty during the data collection period were given an opportunity to participate.

1.9.3.1 Inclusion criteria

- All categories of nurses at the hospital including unit managers, senior professional nurses, professional nurses, enrolled nurses, auxiliary nurses and student nurses.
- All nursing care workers in all departments of the hospital.

1.9.3.2 Exclusion criteria

- Nurses in administrative positions not involved in direct patient care

1.9.4 Data collection tool

The data collection tool was a self-administered closed-ended question questionnaire covering IPC knowledge, attitude and practices (KAP). The instrument had been used in a study of healthcare workers in Nepal (Paudyal, Simkhada and Bruce, 2008). The researcher obtained permission to make alterations in order to ensure that the instrument suited the aim and objectives of this study. The questionnaire consists of 46 items in four sections. The estimated time for participants to complete the survey questionnaire was 20 to 30 minutes.

Section one comprised demographic data: gender, age, level of education, and years of experience. Section two covered nurses' level of knowledge of the IPC programme. Section three pertained to the nurses' attitude toward the IPC programme. Section four had a 3-point Likert scale for the participants to indicate their compliance with IPC. The questionnaire was in English as it is the official language in Namibia.

1.9.5 Pilot test

Shortly before the actual data collection, a pilot test was conducted to determine the feasibility of the study as well as examine the reliability and validity of the instrument. The pilot test data collection was done by a fieldworker, which enabled her to become familiar with the research setting. It was conducted amongst the personnel n=12 (registered nurses [n=7] and enrolled nurses [n=5]). The pilot test was done in the emergency department, as it was identified as one of the departments with good IPC compliance. The data collected were not included in the final data analysis.

1.9.6 Validity and reliability

Validity and reliability were ensured by experts in IPC as well as the pilot and Cronbach Alpha testing. This was done to ensure that data collection was sound and replicable, facilitating accurate results. The adapted data collection instrument was that of Paudyal, Bruce and Simkhada that they used in their study on infection control knowledge, attitude and practices amongst Nepalese healthcare workers (2008: 595 – 597).

1.9.7 Data collection

The researcher is employed at the private hospital as a training facilitator. To avoid bias, a fieldworker was employed for data collection. The fieldworker is a master's graduate familiar with the research process. The research participants were sourced from the personnel of the private hospital. The researcher arranged a meeting with the hospital nursing manager and the hospital general manager to discuss the research study with them, and to submit the research proposal for ethical consideration. Upon obtaining permission from the hospital's ethics committee, the researcher met with the managers of the different units. The purpose of this meeting was to inform them of the proposed

study and to arrange suitable times for data collection as well as to introduce the fieldworker.

The latter explained the research to the potential participants during the five-minute meeting morning meetings of the units. This was done a week prior to the start of data collection. This ensured that all the different departments were contacted. The fieldworker first explained the research to the potential participants; those who consented were given the consent form to complete and return to the fieldworker prior to completing the questionnaire. In order to ensure privacy, the consent form and each completed questionnaire were kept in separate boxes.

Arrangements were made with the hospital general manager to utilise the training facility to collect data. Based on the scheduled duties of the personnel, data collection was done over a period of one week: Sunday to Saturday. Based on the rosters all the personnel who were not on leave had an opportunity to participate in the study. The personnel were allocated a time during their breaks to complete the questionnaire in the selected venue. On the day of data collection, the fieldworker was available in the training room between 7:00 – 15:00 to ensure that personnel from all the shifts had an opportunity to participate in the study, during their breaks or at any time of their convenience.

The participants placed their completed questionnaire in a box before exiting the venue. The box was sealed and handed to the researcher at the end of each day. The completed questionnaires were only reviewed by the researcher, research supervisor and statistician.

1.9.8 Data analysis

As this was a quantitative study statistical procedures were used in examining data gathered. The data were populated on an excel spreadsheet. After which the data were cleaned to identify errors and missing data (Burn & Grove 2011: 373). The data were entered into Statistical Package for Social Science (SPSS 24) by the statistician for

analysis. Descriptive and inferential statistics were utilised for data analysis. Tables, graphs and charts were used to present the data.

1.10 Ethical considerations

Before the researcher commenced with the study, ethical approval was obtained from Stellenbosch University's ethics committee (Annexure A) and the private hospital in which the study was conducted (Annexure B). Permission was further obtained from the line managers in the respective units in which data were collected. Information leaflets (Annexure C) were distributed to the potential participants before consent was obtained. Informed consent was obtained from each participant prior to data collection. This was to ensure that the participants had adequate information about the purpose of the research and its associated risks and benefits (Manti & Licari 2018:145). Furthermore, in an effort to reduce bias a fieldworker facilitated data collection. In addition, the following ethics principles were observed.

1.10.1 Right to self-determination

The right to self-determination is based on the ethics principle of respect for a person, and it ensures that participants are treated as being autonomous (LoBiondo-Wood & Haber 2010:252). The participants were informed that participation in the study was completely voluntary. There were no payments or penalty for participating and they were told that they could withdraw from the study at any stage in the research process, even after they had initially given consent. No coercion or deception was used to recruit participant for this study (Wood &Haber 2010:252).

1.10.2 Right to anonymity and confidentiality

In order to ensure respect, the participants' identity each questionnaire was assigned a research number; the participants were not required to write their names on their completed questionnaire. This ensured that they remained anonymous (Wood & Haber 2010:252). Furthermore, to ascertain confidentiality, the participants placed their respective completed questionnaire in a sealed box. The information provided was not linked to any participant, and no association could be made between the completed

questionnaire and the informed consent provided. Only the fieldworker, the researcher, the research supervisor, and the statistician, had access to the questionnaire content. The completed questionnaires have been placed in a locked cupboard and will be kept for a period of five years.

1.10.3 Right to protection from discomfort and harm

Burns and Grove (2011:533) encourage researchers to do 'good' and above all to do no harm to study participants. The potential benefits of a research study should outweigh any risks. Even though the research study took part in their work environment, the participants' participation did no influence their ward routines or create a threat to their job security. There were no incentives for participating in this study, and participation was voluntary.

There were no predicted risks to the participants in this study. However, if they were to have experienced some emotional trauma, the researcher could have been contacted for debriefing. In addition, the hospital's occupational health nurse was consulted and was available for any counselling or debriefing that may have been required (Wood & Haber 2010:253).

1.11 Conceptual and Operational definitions

- Healthcare-associated infections

These are defined as infections which patients acquire in hospitals or other healthcare facilities during the process of care, and which were not present or incubating at the time of admission as well as occupational infections among staff (WHO-healthcare associated infections fact sheet, 2010:n.p).

- Nurse

A nurse refers to a member in the target population, who is registered or enrolled with the Nursing Council of Namibia, and thus enabled to practice nursing and midwifery as per the scope of practice (Namibian Nursing Act 8:2004). For the purpose of this study, 'nurse' is used as a general term, including professional/ registered nurse, enrolled nurses and enrolled nurse auxiliary.

- Knowledge

This refers to the capacity to gain and retain infection prevention and control information to be used in the prevention of hospitalcare-associated infection. This information is gained through comprehension, experience, discernment and skills (Bano, AlShammari, Fatima & AlShammari 2013:30).

- Attitude

This refers to a susceptibility to react to infection prevention and control practices when faced with an infection prevention and control situation. A person sees and interprets an event based on their own outlook (Bano et. al., 2013:30).

- Practices

The application of infection prevention and control rules and knowledge that lead to action of infection prevention and control compliance (Badran, 1996:8).

- Compliance

This means the adherence of healthcare workers to the IPC programme to at least 80% of the time (Darawad and Al-Hussami (2013:582).

- Infection prevention and control (IPC) programme

This means a programme that can help healthcare organisations monitor and improve infection prevention and control practices, identify risks, and proactively establish policies to prevent the spread of infections (Stor et. al., 2017: 4).

1.12 Duration of the study

Ethical clearance was obtained in November 2017, data collection was completed in June 2018 and data analysis was completed in July 2019.

1.13 Chapter outline

Chapter 1. Foundation of the study

In this chapter, the topic was introduced. The background was given, the rationale for conducting this study and the statement of the problem that stimulated the undertaking of this study were highlighted. A brief overview of the methodology was given.

Chapter 2. Literature review

In this chapter, an overview of the literature review is given to provide a broader picture of the topic.

Chapter 3. Research methodology

The research methodology used in the study is discussed.

Chapter 4. Results

The results of the data collection are analysed and presented.

Chapter 5. Discussion, conclusions and recommendations

After the data analysis, the research findings are discussed in relation to the literature review. Conclusions are drawn and recommendations made.

1.14 Significance of the study

HAIs are recognised as the leading cause of morbidity and mortality within a hospital environment, and therefore associated with an increased length of hospital stay. The current high HAIs prevalence rates is a cause of serious concern, as they are indicative of poor quality care and create a threat to patient safety. This may be viewed to be a result of medical negligence and could lead to litigations brought against healthcare providers. In the presence of an IPC programme, HAIs prevalence indicates a lack of compliance with such a programme. Studies have shown that a lack of compliance may be influenced by inadequate knowledge of an IPC programme, as well as a negative attitude toward the programme or inconsistencies in IPC practices. Therefore, with findings from this study reasons for the lack of compliance are identified. Based on the findings changes can be implemented to rectify such reasons. The relevant stakeholders in IPC will be informed of the results. This will allow those in policy-making positions to make use of this information in policy formulation. Identified shortcomings require training to address such gaps that may have led to poor compliance with the IPC programme. Once these are dealt with it is postulated that compliance should improve and in doing so lead to a reduction in HAIs prevalence in the hospital where the study was conducted.

1.15 Summary

Research shows that HAIs can be prevented by effective implementation of evidence-based programmes. However, healthcare professionals are often faced with numerous challenges that limit their compliance with these programmes. Amongst others, their level of knowledge, attitude and practices (KAPs) have a great influence on HAIs rate in a hospital.

A quantitative, descriptive study was undertaken by means of a questionnaire to obtain data on nurses' knowledge, attitude and compliance towards IPC guidelines in a private hospital in Namibia. The target population was the different categories of nurses working in the different units in the hospital. Given the small target population, no sample size was determined. Convenient sampling was done in order to include all those availablction on duty during the period of data colled and willing to participate in the study.

The data collection took place in the participants' natural setting, where a fieldworker administered the questionnaire. The participants took about 20 minutes to complete the questionnaire. Since some changes were made to the instrument, the face and content validity was determined by a pilot test. SPSS Statistics 24 was used to analyse the data of the questionnaire regarding the knowledge, attitude and practice (KAP) of the nurses in the private hospital and how KAP influenced their compliance with the IPC programme.

The three ethics principles of respect for persons, beneficence and justice were applied throughout the research process.

Upon completion, the research findings will be presented to the relevant hospital authorities as well as the research participants. The researcher hopes that the research finding will facilitate an increase in the level of compliance with the IPC programme and significantly reduce or eliminate HAIs (Amoran & Onwube, 2013).

1.16 Conclusion

The fight against HAIs can be considered fair if those involved optimally utilise the tools at their disposal. In this regard, the CDC guidelines on IPC are the healthcare workers weapons against HAIs. However, mere possession of these weapons is not enough if they are not utilised.

Improving levels of knowledge, fostering positive attitudes and ensuring safe infection control should lead to increased compliance with the IPC programme and a subsequent reduction, or perhaps the total elimination of HAIs. As a result, patient safety and quality care will remain the core of nursing practice.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

An in-depth overview of HAI is presented in this chapter. The variable of nurses' knowledge, attitude and practices of infection prevention and control is discussed. The literature review broadly covers global HAI concerns, including developed and developing countries. Limited literature of HAIs in sub-Saharan Africa is presented in terms of a lack of surveillance in many of its countries. The purpose of this chapter was to gain an understanding of the global stance on HAIs and to establish what is currently known about nurses' compliance with infection protection and control (IPC) programmes. In addition, the literature review provided the researcher with a guide on how adequate knowledge of IPC, attitude and practices impact on HAIs prevalence in a healthcare setting.

2.2 Selecting and reviewing the literature

Use was made of the following key concepts during the literature search: healthcare-associated infection, nurses' infection prevention and control knowledge, attitude and practices. Electronic databases, such as Science Direct, PubMed, ResearchGate and Google Scholar were used to search for journal articles on the topic in this study.

2.3 Healthcare-associated infections (HAIs)

Healthcare-associated infections or infections acquired within healthcare settings are thought to be the most frequent adverse event reported globally (WHO, 2016:n.p). The World Health Organisation (WHO) indicates that out of 100 hospitalised patients, on average seven in developed, and at least ten in developing countries, will acquire one or more HAIs (WHO, 2016.n.p). This has lead to a significant high endemic burden, particularly for low-middle-income countries. The prevalence of HAIs compromises the quality of both patient care and safety (WHO, 2016:1). HAIs are therefore recognised as the most prevalent adverse events and the leading cause of morbidity and mortality within

a hospital environment (Yamakawa, Takasi, Fukuyama, Kitayama, Matsuda & Nakamori, 2011:1).

The prevalence of HAIs in the public sector remains undocumented due to a lack of surveillance. Surveillance ensures timeous identification and prioritisation of HAIs (WHO 2011:7). Lack of resources in the public healthcare is thought to have a negative influence on healthcare workers' adherence with infection prevention and control (IPC) guidelines. Consequently, this leads to a further transmission of HAIs, which then leads to an increased burden on existing limited resources. On the other hand, IPC in the private sector is different, as there is adequate surveillance of HAIs. Therefore, necessary measures should be put in place to ensure that the spread of HAIs is kept under control. Intensive care unit (ICU) patients and new-borns have been identified to be at the highest risk of acquiring HAIs. There are however other risk factors that have been identified to increase patients' odd of acquiring HAIs: suppressed immunity and bypassing of the natural protective mechanism through intubation and invasive devices, for example (WHO, 2010:3).

Infection prevention and control are high on the agenda of the selected private hospital in this study. The IPC committee consists of an IPC manager, a representative from the hospital management team, the clinical manager (patient safety manager), a local pathologist, and a representative for the various nursing and non-nursing departments in the hospital. The role of this committee is to mitigate HAIs in the private hospital. The private hospital has an IPC programme that comprises 'My 5 moments of hand hygiene' compliance, standards precautions as well as 'Best Care always!' (BCA) bundles targeted at respective HAIs.

According to the WHO, at any given time HAIs amongst hospitalised patients range between 3.5% - 12 % in developed countries, and 5.7 % - 19.1 % in developing countries: most occur in the ICU where as many as 51% of patients acquire at least one HAI (WHO, 2016: n.p). There is limited data on HAI prevalence rates in developing countries: more than 60% of developing countries worldwide have no published data on the burden of HAIs (Rothe, Schlaich & Thompson, and 2013:257).

The WHO has determined that the burden of HAIs is greatest in low-middle income countries compared to developed countries (WHO, 2011:3). In view of limited data this

means that the actual impact of HAIs in developing countries cannot be quantified. The presence of HAIs in any setting is a patient safety concern; it creates additional physical and financial suffering for patients and their families (WHO, 2011:3). The prevalence of HAIs amongst hospital patients is believed to lead to prolonged hospital stays, long-term disability, increased antimiocrobial resistance, increased financial burden on the healthcare systems, generation of high costs for patients and their families, and may lead to unnecessary deaths (WHO, 2016:3).

A private hospital in a developing country was the setting in this study. Despite there being an IPC programme in place, the prevalence of HAIs remains above the benchmark. The researcher undertook this study to detemine the reason for lack of compliance in terms of the IPC programme. The presence of HAIs within a healthcare setting is considered to be inevitable. Such prevalence is believed to be precipitated by factors such as prolonged and inappropriate use of invasive devices (in-dwelling urinary catheters, central lines, endotracheal tubes), high risk and complex procedures, inadequate environmental hygienic conditions and waste disposal, poor knowledge and application of basic IPC measures, lack of knowledge on safe injection practices and the absence of local and national IPC guidelines and policies (WHO, 2016:n.p). These factors create a great negative impact on patients and a healthcare system.

The high HAIs rate is a result of the spread of pathogens that are transmitted between patients by healthcare workers through various routes including contact (direct or indirect), respiratory (droplets or airborne), ingestion as well as during inoculation (Dramowski, 2018:50). Even though HAIs are most prevalent in hospitalised patients, healthcare workers are also at risk of acquiring HAIs such hepatitis B, HIV as well tuberculosis and influenza through needle stick injuries and respiratory routes respectively (Dramowski, 2018:38). Viral, bacterial and fungal pathogens are responsible for most common HAIs from person to person, unclean hands and medical procedures.

2.3.1 Common HAIs, associated pathogens and best practices

Common HAIs in healthcare settings are: central line-associated blood stream infection, catheter-associated urinary tract infection (CAUTI), ventilator-associated pneumonia (VAP), surgical site infections (SSI), and *Clostridium difficile* infections (CDI).

2.3.1.1 Central line-associated blood stream infection (CLABSI)

CLABSI is defined as a primary blood stream infection occurring in a patient with a central venous catheter in situ, or infection occurring within 48 hours after removal (Best Care Always, 2018). A central venous catheter (CVC) is a large bore catheter that is inserted using a sterile technique. There are three common sites for insertion of a CVC: the internal jugular vein, the subclavian, and the femoral vein (Tse & Schick, 2017:n.p). Indications for the insertion of a central line catheter include fluid resuscitation, drug infusion that could otherwise cause peripheral phlebitis and sclerosis, central venous pressure monitoring, the introduction of a pulmonary artery catheter, emergency venous access in case of difficult peripheral access, and total parental nutrition (Tse & Schick, 2017:n.p).

The placement of a central line has many benefits, but it is also associated with some complications: infection is at the top of the list. Studies suggest CLABSI to range from 0.8 per 1000 device days in developed countries (Haddadin & Regunath, 2019:n.p) up to 5.9 per 1000 device days in developing countries with limited resources (Geldenhuys, Dramowski, Jenkins & Bekke, 2017:758). The most common pathogens in CLABSI are *Staphylococcus aureus* and *Staphylococcus epidermis*, which may originate from contaminated skin flora, contaminated infused substance or haematogenous spread from an unrelated site (Kambau, Lee, Hughes & Firstenberg, 2015:175). Femoral vein catheters have the highest risk of infection: an un-cuffed catheter's risk is lower compared to that of a cuffed one: increasing the number of lumens increases the risk of CLABSI whereas use of antibiotic-impregnated catheters significantly reduces CLABSI risks (Kambau *et al*., 2015:175). In order to reduce the risk of infection, the need for a CVC is reviewed daily, and is removed when no longer necessary. The routine removal of a CVC is no longer recommended. A CVC may remain in situ for as long as necessary in the absence of any signs of infections. However, in order to prevent infections, it is recommended that the dressing covering the insertion site be changed after two days for gauze dressings and seven days for sterile transparent dressing, or at any point in the event when it becomes damp, lose or visibly soiled (CDC, 2017:n.p).

2.3.1.2 Catheter-associated urinary tract infection (CAUTI)

CAUTI is defined as any urinary tract infection occurring in a patient who has an in-dwelling urinary catheter, or infection occurring within 48 hours after removal (Best Care Always, 2018). A CAUTI is amongst the leading HAIs attributing to 20 % of all HAIs in healthcare facilities, and 50 % of HAIs in long term care facilities (Nicolle, 2014:1). Most urinary tract infections (UTIs) are believed to be associated with in-dwelling urinary catheters (Schiessler, Darwin, Phipps, Hegemann, Hetbrock & MacFaydyen, 2019:183). The risk of infections is significantly increased in the presence of invasive devices. Moreover, these infections are caused by a biofilm that eventually develops on the device (Nicolle, 2014:1).

Barbadoro, Labricciosa, Recanatini, Gori, Tirabassi *et al*. (2015: 707) in their study found that 6.2 % of patients with an in-dwelling catheter longer than 48 hours developed CAUTI. The most common pathogens responsible for these CAUTIs were *Pseudomonas aeruginosa* (41.5%), Klebsiella *pneumoniae* (19.5%), and *Escherichia coli* [*E. coli]* (12.2%), and 82.2% were reported to be resistant to antibiotics (Barbadoo *et al*., 2015:709).

The presence of CAUTI has a significant impact on a healthcare system, as such infections are associated with unnecessary post-operative morbidity and increase the length of hospital stay complicating post-operative recovery and treatment (Umer, Shapiro, Hughes, Ross-Richardson & Ellner, 2016: 197). In addition, CAUTIs are believed to create a great financial loss for healthcare facilities due to their frequency even though they remain relatively inexpensive (Umer *et al*., 2016: 201).

2.3.1.3 Ventilator-associated pneumonia (VAP)

Ventilator-associated pneumonia is a type of healthcare pneumonia that occurs in ventilated patients approximately 48 -72 hours of mechanical ventilation (Charles, Kali, Easow, Joseph, Ravishankar, Srinivasa, Kumar & Umadevi, 2014:334). Patients develop VAP when they aspirate pathogens that colonised the oropharynx and the gastrointestinal tract (GIT); VAP occurs in up to 27 % of all ventilated patients (Sadasivan, George & Krishnarkumar, 2018: 440). Charles *et al*. (2014:340), identified the following factors that increase a patient's risk of developing VAP: the duration of mechanical ventilation; the types of ventilator circuits and the frequency at which they are changed; the position of a

patient; the used of sedation and paralytic agents and H2 blockers (peptic ulcer prophylaxis).

Charles *et al*. (2014: 336) further state that the incidence of VAP is 13 – 51 per 1000 ventilator days, with a mortality rate of up to 76%. VAP increases a patient's ICU stay and comes with financial implications. VAP is commonly associated with gram-negative bacteria such as *Pseudomonas aeruginosa, Enterobacteriaceae, staphylococci, Streptococci* (Sadasivan *et.al*., 2018: 440).

2.3.1.4 Surgical site infections (SSI)

A SSI can be defined as any infection that is related to surgery that occurs within 30 days when there was no implant or up to one year if an implant was placed (Darouiche, 2016:1). In the United States of America (USA), approximately 27 million surgeries are performed each year, out of which 5% of patients will develop a SSI (Darouiche, 2016:1). In Europe and other developed nations, the prevalence of SSI ranges from 0.6 % to 9.5% of all post-operative patients (Olowo-Okere, Ibrahim, Olanyika & Ihinmindu, 2019:145). There is a lack of surveillance in sub-Saharan countries. Nonetheless the incidence of SSI is reported to occur in 14.8% of patients post-operatively, and is responsible for 77% of deaths (Olowo-Okere *et.al*., 2019: 144). Following a SSI, a patient has a 60% chance of ICU admission, and is five times more likely to be readmitted after discharge, and length of hospital stay increases by 7 – 10 days, resulting in increased cost for the patient and a healthcare system (Darouiche, 2016:2; Olowo-Okere, 2019). The incidence of SSI, at a rate of five SSI per 100 surgical procedure, is estimated to cost a staggering 3.2 – 10 billion US dollars per annum (Darouiche, 2016:2).

SSIs are most commonly caused by endogenous micro-organisms that are present on a patient's skin at the time of an incision. However, they may also be a result of micro-organisms within a patient when exposed during surgery, or from exogenous sources such as surgical instruments, operating room surfaces, the air and the practices of healthcare workers (Darouiche, 2016:3). The most common SSI causal pathogens are *E. coli, E. faecalis*, MRSA, *Klebsiella pneumoniae*, *B. fragilis* and *E. cloacae (*Takesue, Kusachi, Mikamo, Sato, Watanabe *et al*., 2018: 337). These strains produce toxins that cause damage to tissues.

Darouiche (2016:4) states the associated risks of a patient developing SSI include: age of a patient, co-morbidities such as diabetes mellitus, the use of steroids, a patient's social habit, poor health and nutrition as well as infection or colonisation at a remote body site, and length of preoperative hospital stay. Darouiche (2016:5) identified the following variables to influence a patient's risk of developing SSI.

- Antimicrobial prophylaxis administered 30- 60 minutes before an incision is made, reduces the risk of a patient developing SSI
- Preoperative hair removal: hair clipping rather than shaving is recommended as shaving creates small cuts that may lead to the migration of endogenous microorganisms
- Skin antiseptic protocol: three chlorohexidine gluconate showers are recommended pre-operatively. A patient should not apply lotions of cream after the showers.

2.3.1.5 *Clostridium difficile* infections (CDI)

Clostridium difficile causes 20 – 30 % antibiotic-associated diarrhoea, and is the leading cause of diarrhoea amongst hospitalised patients (Chakra, Pepin, Sirard & Valiquette, 2014:1). In a study conducted in 10 healthcare facilities in the USA *c.diff* was found to be responsible for 15 461 cases of diarrhoea; 65.8% of which were healthcare-associated while only 24.2% had onset prior to hospital stay (Lessa, Mu, Bamberg, Beldavs, Dumyati, Dunn *et al*., 2015:825). The risk of recurrence was 20.9%, with a 9.3% mortality within 30 days (Lessa *et al*., 2015:826).

There was a 30.1% readmission rate of discharged patients who had *c.diff* compared to a 14.4% readmission rate for those without c.diff (Chopra, Neelakanta, Dombecki, Awali, Sharma *et al*., 2015:315). This leads to an increased financial burden on a patient.
In order to curb the prevalence of HAIs, in particular CLABS, CAUTI, VAP, SSI and CDI, it is paramount that healthcare facilities have an established effective IPC programmer with monitoring and evaluation practices.

According to Hand (2014:n.p), the Centres for Disease Control (CDC) reported pneumonia (21.8%) and SSI (21.8%) to be the most common HAI, followed by GIT infections (17.1%) in developed nations. *Clostridium difficile* was identified as the most prevalent pathogen and it was responsible for 12.1% of all HAIs and 70.9% of GIT infections, followed by *Methicillin-resistant Staphylococcus Aureus* (MRSA) which accounted for 10.7%, and *Klebsiella pneumonia* and *K oxytoca* (9.9%) and *Escherichia coli* (9.3%) (Hand, 2014:1198-1208).

The CDC reported a decrease in HAI rates in recent years: 50 % decrease in CLABSI, 17 % decrease in SSI, 8 % decrease in *C. diff*, 13 % decrease in MRSA infections, but no notable change in the rates of CAUTI (CDC, 2016: 2).

In Namibia, which is a sub-Saharan country, there is no active HAIs surveillance in most state-owned healthcare facilities. Some privately-owned healthcare facilities in this developing country do have active HAIs surveillance. However, there is no available published data. The best practices at the healthcare facilities are managed by IPC offices as well as to prevent and control the spread of infections.

2.4 Infection prevention and control

The prevention and control of HAI is important for patient safety and an effective high-quality initiative by healthcare managers in healthcare facilities as it impacts the epidemiology of HAI (Wang Liu, Tan, Harbarth, Pittet & Zing, 2019: 2). IPC programmes are effective when they are recognised by healthcare managers, and supported by an active IPC committee to manage and follow-up HAI cases (Yohannes, Kassa, Laelago & Guracha, 2019: 12). IPC teams and committees are quality makers for the success of IPC programmes (Storr *et al.*, 2017: 7). The implementation and management of an IPC programme should be budgeted for as it mitigates healthcare-related infections, which have a considerable impact on the time spent by a patient and costs of hospitalisation (Salem, 2019:1). IPC researchers, together with the WHO Guidelines Development Group, argue that developing relevant evidence-based national IPC guidelines and

strategies are key functions of a national IPC programme (Storr, Twyman, Zingg, Damani, Kilpatrick, Reilly, Price, Egger, Grayson, Kelley & Allegranzi, 2017: 5).

The WHO stipulates that IPC measures should aim to ensure the protection of the vulnerable who might acquire an infection while receiving healthcare due to health illnesses (Salem, 2019: 422). Prevention and control of infection such as HAI, by means of an IPC programme, strengthens a healthcare system (van der Westhuizen, Nathavitharana, Pillay, Schoeman & Ehrliche, 2019:1).

2.5 The IPC programme

The private hospital in this study has an IPC programme that comprises standard precautions as well as Best Care Always (BCA) bundles targeted at respective HAIs. The elements of the IPC programme are discussed below.

2.5.1 Standard precautions

Standard precautions are the minimum infection prevention practices in patient care whether an infection is suspected or confirmed (CDC, 2018:n.p). These IPC procedures should be consistently adhered to with all the patients and not only when they are known to be infectious.

Standard precautions consist of the following elements: hand hygiene, the use of personnel protective equipment (PPE), respiratory hygiene/cough etiquette, sharps safety, waste management, and patient placement.

2.5.1.1 Hand hygiene

The hands of healthcare workers have been identified as the main route for the transmission of pathogens causing HAIs (Dramowski. 2018: 89). To prevent these transmissions it is vital that healthcare workers consistently perform hand hygiene at each moment recommended. Hand hygiene refers to a procedure of cleaning and/or decontaminating hands using alcohol-based hand rub or soap and water (Kilpatrick, Randle & Prieto, 2014:37. It is considered the most effective means to reduce the risk of HAIs for patients and healthcare workers (Kilpratrick *et al*., 2014:37). Hand hygiene is an effective method of removing micro-organisms from the hands of healthcare workers, but

it does not make hands sterile thus extra precaution should be used when conducting invasive procedures (Wistrand, Soderquist, Falk-Brynhidsen & Nilsson, 2018: 5). For this reason, healthcare workers should ensure that any minor skin lesions are covered with a waterproof dressing (Dramowski, 2018: 91).

There are different methods of performing hand hygiene. These can be through a routine wash with soap and water for 40 -60 seconds, washing with an antiseptic soap for 3 -5 minutes, or by rubbing with alcohol 20-30 seconds (Dramowski, 2018: 92). An alcohol hand rub should not be used when hands are visibly soiled with dirt or blood and bodily fluids or after contact with a patient with *C.diff* (Dramowski, 2018: 94).

According to Sax, Allegranzi, Uckay, Larson, Boyce and Pittet (2007:14) there are five key moments at which healthcare workers should perform hand hygiene. These moments are presented below.

- Moment 1.Before patient contact

It occurs between the last object in a healthcare zone before making contact with any object of a patient (Sax *et al*., 2007:14). Performing hand hygiene at this point will eliminate exogenous infections reaching a patient (Sax *et al*., 2007:14). The WHO recommends that healthcare workers should perform hand hygiene consistently before and after they have been in contact with patients. For example, after touching a door handle, a nurse must perform hand hygiene before making contact with a patient.

- Moment 2. Before an aseptic procedure

When a nurse is within a patient zone, hand hygiene must be performed before conducting an aseptic procedure such as changing an IV vacolitre, administration of an injection, perfoming wound care, and administration of injections (Sax *et al*., 2007:14). These are invasive procedures and may result in the direct transmission of micro-organisms to a patient if hand hygiene is inadequate.

- Moment 3. After body fluid exposure risk

After healthcare workers undertake a task where there is a risk of their hands being exposed to bodily fuid, hand hygiene must be performed immediately before making contact with any other object even within the same patient zone (Sax *et al*., 2007: 14). This may be after emptying a urinary catheter, or checking an IV infusion site. The purpose of hand hygiene at this point is to prevent colonisation of the hands of healthcare workers as well as colonisation of clean site/surface with micro-organisms from bodily fluids (Sax *et al*., 2007:14).

- Moment 4. After patient contact

Hand hygiene must be performed before any contact is made with any object in the healthcare zone when there as any interaction where a nurse had direct contact with a patient: haking hands, reposition of a patient, for example (Sax *et al*., 2007:14). This is to ensure the prevention of cross-infection between a patient zone to a healthcare zone as well as colonisation of a healthcare worker (Sax *et a*l., 2007:14).

- Moment 5. After contact with a patient surroundings

At this moment, hand hygiene must be performed after healthcare workers have been in contact with objects in a patient's zone without touching the patient (Sax *et al*., 2007: 17). The objects within a patient zone are believed to be contaminated with the patient's flora/ micro organisms, thus hand hygiene is required even if a nurse did not come in direct contact with a patient.

2.5.1.2 Personal protective equipment (PPE)

Personal protective equipment (PPE) refers to protective clothing, helmets, gloves, face shields, goggles, face masks and respirators designed to protect a wearer from infection by creating a barrier between infectious materials such as viral and bacterial contaminants and a wearer's skin, mouth, nose, eye (mucous membranes) (U.S Food and Drug Administration, 2018:n.p). The use of PPE is to improve staff and patient safety; it significantly reduces the risk of micro-organism transmission. However, self-contamination usually occurs because of a failure to remove PPE carefully, which leads

to contamination of the skin, own clothes, uniforms, hair and hands of healthcare workers (Pang, Carter, Scott, Salazar & Johnson, 2014:14).

Gloves are the most common types of PPE used within a healthcare setting for the purpose of IPC. Gloves protect hands when there is direct or indirect contact with a possibly infectious agent. Gowns/aprons protect skin; clothing and goggles protect the eyes; a face mask and N95 respirator protect the respiratory tract against airborne infectious agents; and a face shield protects the face, mouth, nose and eyes whenever there is a risk of blood or bodily fluid splashing (Mehtar, 2010:169).

Gloves have been reported to be the most common PPE used in healthcare facilities, where some healthcare workers replace hand hygiene with gloves use. Hand hygiene remains vital, as one's hands could be contaminated through the gloves (Dramowski, 2018:73). Not every contact with a patient requires gloves, therefore the need for gloves depends on a thorough risk assessment (Mehtar, 2010:168).

The use of gloves is recommended for surgical procedures, invasive aseptic procedures, any procedure that may expose a nurse to a patient's blood or bodily fluids: upon removing of gloves, hands should be washed with an antiseptic soap and water (Dramowski, 2018:169). In addition, gloves should be changed and hand hygiene performed between procedures even on the same patient, as well as between patients (Mehtar, 2010:168).

2.5.1.3 Respiratory hygiene/cough etiquette

The CDC (2018: n.p) recommends the following respiratory hygiene guidelines: cover your mouth and nose with a tissue when coughing or sneezing; dispose of the tissue immediately after use; and perform hand hygiene after having contact with respiratory secretions and contaminated objects

2.5.1.4 Waste management

Waste management is the handling and safe disposal of infectious and non-infectious waste to ensure safe and environmentally friendly destructuion and reprocessing of healthcare waste (Dramowski, 2018:121). According to the WHO, 85% of healthcare

waste is considered to be non-hazardous general waste, which is the same as domestic waste, while the remaining 15% is infectious, toxic and radioactive (WHO, 2018:n.p). Therefore, putting measures in place to ensure safe and environmentally sound management of healthcare waste will prevent an adverse impact on the environment and the health of patients and community as a whole (WHO, 2018: n.p). For this reason, the guidelines for waste segregation should be strictly adhered to at all times. Table 2.1 illustrates the types of waste segregation.

Table 2.1: Waste segregation (Dramowski. 2018: 122)

Waste category	**Examples of items**	**Recommended colour coding**
Anatomical tissues and clinical waste, materials visibly contaminated with blood and bodily fluids or infectious agents	Placenta, amputated human tissue, used bandages and dressings, urinary catheters and drainage bags, abdominal swabs, item used in isolation areas such as gloves, apron and linen saver etc	Red bag
Non-clinical waste not contaminated with blood or bodily fluid	Paper towels, gloves and aprons, surgical masks, disposable caps and gowns etc	Black household bag
Sharps, sharp objects that are contaminated with blood and body fluids	Hypodermic needles, vials, syringes, insertion ends of intravenous administration sets, trochars, canulae, rigid guide wires	Yellow sharps' container

2.5.1.5 Sharps safety

The presence of sharp objects in a hospital in inevitable. However, sharp safety is vital to ensure that the risk of infection transmission is reduced. For this reason, the CDC recommends that all sharp objects contaminated with a patient's bodily fluid are to be considered to be infectious; needles should not be recapped after use to reduce the risk of needle stick injuries; healthcare workers should however use the one-handed scoop (CDC, 2018:n.p): Furthermore, used disposable syringes, needles, scalpel blades and other sharp objects must be placed in designated punture resistant containers located as close as possible to the area where these items are being used (CDC, 2018:n.p).

2.5.1.6 Patient placement (isolation)

Isolation areas are rooms or areas that are designed to separate infectious patients from susceptible ones and to protect immunocompromised patients from potential exposure to harmful pathogens (Dramowski, 2014:106).

An isolation area should should preferably be located at the far end of an unit to avoid heavy traffic in front of the room and possible exposure and should include: adequate floor space that is easy to clean, adequate ventilation, a door that is kept closed at all times, a hand wash basin inside the room as well as a toilet and bath in order to ensure an isolated patient does not leave the room often (Dramowski, 2014:106).

2.5.2 Transmission-based precautions

According to the CDC, transmission-based precautions are a second tier of precaution taken in addition to standard precautions when a patient is known to be infected or colonised with a certain infectious agent (CDC, 2017:n.p). Transmission-based precautions focus on contact, droplet, and airborne precautions.

2.5.2.1 Contact precautions

Contact precaution is used when a patient has an infection that is known to be transmitted through contact, such as diarrhoeal disease or a skin or wound infection (Dramowski,

2014:71). In addition to standard precautions, such a patient must be placed in a single room with limited movement, and only transport such a patient out of the room to medically necessary interventions. When moving such a patient out of the room, the infected site should be covered. Furthermore, all healthcare workers should wear appropriate PPE when entering the patient's room, and dispose of them upon exit. If possible any equipment used on the patient should be discarded, or disinfected thoroughly before being used on other patients (CDC, 2017:n.p).

2.5.2.2 Droplet precautions

Droplet precautions are used for patients with infections that are known to be transmitted via the respiratory route when patients are coughing, sneezing or talking (CDC 2017:n.p). This includes actions such providing a mask to an infected patient, placing in infectious patient in a single room with limit movements, and mandatory PPE use when in contact with such a patient (CDC, 2017:n.p).

2.5.2.3 Airborne precautions

Airborne precaution is taken when a patient is known to have an infection that can be transmitted via the airborne route. This includes diseases such as tuberculosis, measles, chicken pox, and disseminated herpes zoster. In order to prevent the transmission of these infections means taking precautions for droplet risks, and the use of a proper fitting NIOSH approved N95 respirator, and immunisation of susceptible personnel immediately after contact with a patient with an airborne infection (CDC, 2017:n.p).

2.5.3 Best Care Always (BCA) bundles

In addition to standard precautions and transmission-based precautions, the hospital in this study has adopted the BCA bundles that target specific HAIs (BCA Bundles, 2012: n.p). Each bundle consists of elements that should be carried out for each patient at all times. Each bundle is discussed below.

2.5.3.1 CAUTI care bundle

- Urinary catheter checklist to be completed at insertion and must be available in a patient's file. This checklist indicates that the insertion of a catheter was done in an aseptic manner, and no colonisation took place.

- Catheter care should be part of a patient's nursing care plan. This will provide a guide on cleaning and decontamination of a catheter.

- The type of catheter that is in situ, as this will determine how long it stays in situ.

- Securing a catheter to a patient's leg to prevent traction. If this is not done then this may result in abrasions in the urethra which will facilitate the migration of micro-organism into the bloodstream

- The urinary catheter bag should hang below a patient's hip, in order to prevent backflow of urine that has collected in the bag.

2.5.3.2 CLABSI care bundle

- Central line insertion checklist to be completed on insertion, to determine asepsis during line insertion.

- Days device is in situ: the guideline indicates that the central line may stay in for a length of 7 to 10 days.

- Review whether the central line is still necessary or a peripheral IV access will be sufficient. This has a lower infection risk for a patient.

- The dressing that covers the central line should be clean, dry and intact. Any contamination will result in colonisation with micro-organisms.

- Hand hygiene must be performed when in contact with the central line, to prevent cross-infection from the hands of a healthcare worker.

- Needleless ports are clean as any contamination will lead to micro-organisms migrating into the line bloodstream during injection administration.

2.5.3.3 ICU VAP bundle

- The head of the bed should be elevated to between 30 – 45 degrees. This will mobilise secretions in a patient's lungs to prevent actelectasis and also prevent aspiration.

- Sedation vacation to give a patient a chance to breathe on their own in order to establish the need for mechanical ventilation.

- Peptic ulcer prophylaxis to be prescribed for a patient, to prevent the formation of stomach ulcers.

- There should be four-hourly oral care with chlorhexidine mouth wash. In order to minimised micro-organisms and prevent them being ingested when a patient eats food.

2.5.3.4 SSI care bundles

- Antimicrobial prophylaxis administered 30-60 minutes before surgery commences.

- Antiseptic chlorhexidine solution showers to remove patient flora from the skin.

- Clippers to be used for hair removal and not razor blades: the latter may cause cuts and abrasions that form a point of entry for the micro-organisms into a patient's bloodstream.

- Post-operative blood glucose to be checked to ensure it is within the normal range; a high glucose level promotes the growth of microbes.

- Patient's temperature maintained peri-operatively to prevent the growth of micro-organisms during a fever episode.

2.5.4 Environmental cultures

According to Mehtar (2010: 57) environmental factors influence the spread of HAIs. This is due to multiple resistant flora that may be associated with a prolonged hospital stay,

specialised units with specialised bacteria, extensive use of disinfectants, contamination of items used on patients, and poor waste management (Mehtar, 2010:57).

2.5.5 Sterilisation and medical device decontamination

There has to be decontamination to reduce a risk of infection transmission resulting from contamination of items used by a patient. Spaulding classification is used to provide a guideline on cleaning and decontamination of the medical devices (Mehtar, 2010:80), as shown in Table 2.2.

Table 2.2: Spaulding classification for reprocessing of medical devices (Mehtar 2010:80)

Classification	Area of use	Requirement	Examples
Critical items	Sterile tissues, cavities and vascular system	NO microbes, including spores Must be cleaned and sterilised before patient use	Surgical instruments
Semi-critical	Contact with intact mucous membrane, e.g. previously colonised sites or broken skin	NO vegetative forms of bacteria A few spores may be acceptable Cleaned and high-level disinfestation	Respiratory equipment, non-invasive endoscopes, vaginal specula
Non-critical items	Coming into contact with intact skin	NO nosocomial or transmissible pathogen	Thermometers

		Thorough cleaning with possible low-level disinfection	

2.6 IPC education and training

According to Kaur, Stone, Travers, Cohen and Herzig (2017:2), IPC education and training play a crucial role in IPC guideline adherence. Various studies found a lack of IPC knowledge amongst healthcare workers; the WHO thus recommends that IPC education should form part of a facility's training for new employees during orientation as well as a continuous professional development initiative for incumbent employees irrespective of their level and position. Doing this has been proven to increase hand hygiene compliance and subsequently reduce the incidence of HAIs (WHO IPC guidelines, 2016:40). The lack of awareness, and lack of training and education, was found to be reasons for most nurses having poor knowledge of standard precautions (Salem, 2019:424). Postgraduate IPC training should be part of a tertiary hospital's environment (Wang *et al*., 2019:1).

IPC training activities are associated with an increase in IPC knowledge, improvement of hand hygiene practices, and a decrease of HAI cases (Wang *et al*., 2019:5).

2.7 Monitoring and evaluation of an IPC programme

Monitoring and evaluation are used to achieve behaviour adaptation and process' changes to improve the quality of care in order to reduce the spread of HAIs. Feedback generated from monitoring is used to inform healthcare stakeholders, creating partnerships and developing working groups and networks in the pursuit of patient safety (Storr *et al*., 2017: 7). Sharing of audit results is done to target individual as well as organisational change.

2.8 Conceptual framework

The conceptual framework used in this study includes the theory of planned behaviour by Icek Ajzen (McGaw *et al*., 2012:6). In order for nurses in a hospital environment to comply

with an IPC programme, their knowledge, attitude and practices (KAP) of infection prevention and control should be in place.

2.9 Compliance with the IPC programme

Various researchers maintain that a reduction of HAIs is possible. However, this is dependent on the extent to which healthcare workers comply with an IPC programme (Darawad & Al-Hussami, 2013:582). To achieve a compliance rate of 80% or more, adequate knowledge and a positive attitude towards IPC are essential (Hamishecker *et al.*, 2014:51; Ward, 2012:302).

A study by Jeong, Park, Lee, Song and Lee (2013:712) suggests that the effectiveness of any IPC programme is dependant on consistent compliance. Darawad and Al-Hussami (2013:582) indicate that in order to render an IPC programme effectively, there should be at least 80 % compliance with the elements of the programme. A lack of compliance with an IPC programme is evidenced by a high HAIs prevalence (Jeong *et al*., 2013:712).
To ensure compliance with an IPC programme, requires healthcare workers to have adequate knowledge and a positive attitude towards it (Liu, Song, Wang, Kang, *et al.*, 2013:834; Darawad & Al-Hussami, 2013:582; Ojulong *et al.*, 2013:1071). The KAP factors are discussed in detail below.

2.9.1 Knowledge of infection prevention and control

“Knowledge is power” is a famous quote by Francis Bacon. In order to empower nurses in prevention and control of infection, it is paramount that they have adequate knowledge of the subject. To increase compliance, nurses require adequate knowledge of an IPC programme; inadequate knowledge affects the extent to which they comply with the programme (Garland, 2013:149).

A study on KAP of nurses towards the management of HAIs in a clinical centre in Kosovo, indicated that 90% of the 331 nurses had adequate knowledge of infection control (Gruda & Sopjani, 2017: 84). Their study showed that the level of knowledge of nurses was directly influenced by their work experience (Gruda & Sopjani, 2017: 86). These results

were similar to an earlier study that assessed knowledge and practices of infection control among healthcare workers in a tertiary referral centre in northwest Nigeria; the healthcare workers were found to have adequate knowledge of IPC (Illiyasu, Dayyab, Habib, Tiamiyu, Abubakar, Mijinyama & Habib, 2016:34).

A study by Hussen, Estifanos, Melese and Moga (2017:1) on KAP of infection prevention measures among 282 healthcare workers in a teaching and referral hospital in Ethiopia produced similar results: healthcare workers were found to have adequate knowledge of IPC. They reported that male healthcare workers had a better knowledge of IPC, and those in surgical units had better practices of IPC (Hussen *et al*., 2017: 6).

A study conducted to assess the knowledge and attitude of infection prevention and control among healthcare students at the University of Namibia found that medical students had better knowledge of IPC in comparison to nursing and radiography students (Ojulong, Mitonga & Iipinge, 2013: 1071). This may be because of limited IPC training in nursing and radiography students (Ojulong *et al*., 2013: 1075).

Healthcare workers do not always have adequate knowledge of IPC. A Yemeni study on the knowledge and practices of nurses, regarding nosocomial infection control measures in private hospitals in Sana'a City, found that 64.7% of nurses had received training in IPC and 78.8% had IPC work experience, but the majority only had a fair knowledge of IPC (Alrubaiee, Baharom, Shahar, Daud & Basaleem, 2017:1). Other studies reported similar results of nurses having inadequate IPC knowledge (Sarani, Balouchi, Masinaeinezhad & Ebrahimitabs 2016:193; Teshager, Engenda & Worku, 2015:1; Osuala & Oluwatosin 2017: 53).

Inadequate knowledge was reported in a study to be influenced by age and experience level. Older and more experienced nurses scored lower than younger less experienced nurses (Osuala & Oluwatosin, 2017: 58). This could be that older nurses may be resistant to change to adapt to new evidence-based practice.

Garland (2013:140) reported that healthcare professionals in developed countries have adequate knowledge of IPC programmes. As a result, this has translated to low HAIs prevalence rates in developed countries (Hand, 2014: n.p). A study conducted in another developed country found healthcare professionals to have inadequate knowledge IPC programme (Bergamini, Cucchi, Stefanati, Cavallaro & Gabutti, 2009:100). On the other

hand, knowledge of an IPC programme alone does not guarantee compliance and low HAI prevalence rates noted in developed countries. Alkubati *et al.* (2015: 27), in their study in Egypt, which is a developing country, also reported healthcare workers to have inadequate knowledge of an IPC programme. Such a level of knowledge did have an influence on the compliance with the IPC programme hence the high HAIs prevalence rates reported in developing countries (Ider, Adams, Morton, Whitby & Clements, 2012:170).

Generally, in developing countries, when compared to other healthcare professionals, nurses scored significantly lower, suggesting their knowledge of IPC was inadequate (Hamadah Kharaz, Alshangity. Al Famoz, Eshaq & Abu-Zaid, 2015:315; Asadpour *et al.*, 2015:103). However, ICU nurses' level of knowledge was on average 59.9% (Jansson *et al.*, 2013:219). Despite this, knowledge alone is not enough to improve healthcare workers' compliance with any IPC programme, which would subsequently reduce the rate of HAIs (Jansson *et al.*, 2013:216). In addition to knowledge, the attitude of the healthcare workers plays a major role in influencing their compliance (Hamishecker, Vahidinezhad, Mashayeskhi, Asgharian, Hassankhani & Mahmoodpoor, 2014:51.)

2.9.2 Attitude towards infection prevention and control

According to the theory of planned behaviour, a person's attitude toward a behaviour is based on three aspects (McGaw, Tennant, Harding, Cawich, Crandon & Walters, 2012:6).

- A person's beliefs of the consequences that will result from their actions. If nurses know and understand the consequences their actions or omissions will have, their attitude towards IPC will be positive.
- Perceived control: the level of hardship with which the task/behaviour can be executed. IPC guidelines are based on evidence-based best practices. However, if nurses perceive the programme to increase their workload, this will negatively influence their attitude towards IPC.
- Subjective norms: how socially accepted the behaviour is. The IPC culture that is practices in the the healthcare facility, provide a guide for what is generally accepted as normal.

- Nurses may understand the importance of an IPC programme, but their attitude towards it determines the extent to which they comply with it. If a nurse has a positive attitude towards IPC this will lead to an increase in compliance. On the other hand, a negative attitude will lead to reduced compliance and a concomitant increased rate of HAIs.

Nofal, Subih and Al-Kalaldeh (2017:187) conducted a study on factors influencing compliance to the infection control precautions among nurses and physicians in Jordan; they found the healthcare workers to have a positive attitude towards IPC, which resulted in compliance with the IPC programme. This study was conducted in three hospitals, one of which was a private hospital.

Gruda and Sopjani (2017:85) reported that the nurses scored an average of 84.4% attitude towards infection prevention and control. This coupled with a 90% overall score for knowledge, resulted in satisfactory IPC practices (76.2%) (Gruda and Sopjani 2017:86). Furthermore, another study in Ethiopia among 271 healthcare workers found that 93.4% had a positive attitude, 99.3% had had adequate knowledge (Hussen *et al*., 2017:3 - 4). Despite, only 60.5% of the healthcare workers had good IPC practices (Hussen *et al*., 2017:5).

On the other hand, study on KAP of nurses about standard precautions for HAIs, in teaching hospitals affiliated to Zabol University of Medical Science, found most of the nurse to have poor knowledge of IPC (43%), a moderate attitude (37%) and average IPC practice (4%) (Sarani *et a*l., 2016:195). According to Ward (2012:302) nurses who had a negative attitude towards IPC and viewed it as an added burden on their workload; adherence for the programme increased when more senior personnel such as an IPC nurse was present in the department Ward (2012:651).

The burden of infection prevention and control should be everyone's business including patients and their visitors. Involving patients and visitors should ensure they take necessary precautions to prevent the spread of infections, as well as keep healthcare workers accountable particularly with hand hygiene practices (Sutton, Brewster &Tarrant, 2019:652). This would encourage healthcare workers to consistently adhere to IPC guidelines, and not just when supervisors/seniors are in a department.

2.9.3 Practices of infection prevention and control

Practice is defining as something that is usual or regularly done, and has become a custom, habit or tradition (Cambridge online dictionary). In this context, good practice of infection prevention and control means consistent and habitual application of the IPC guidelines as prescribed in an IPC programme. Consistent good IPC practices are recommended to achieve the 80 % compliance recommended to adequately reduce HAIs rates.

A study by Hussen *et al*. (2017: 1) found 60.5% of healthcare workers did comply with the IPC programme. They highlighted that male healthcare workers had poorer IPC practices when compared to female healthcare workers. Those working in surgical, obstetrics and gynaecology, and the paediatrics departments were less likely to practice IPC compared to healthcare workers in the medical departments (Hussen *et al.,* 2017: 6).

A study of 197 nurses on infection control found that 50% had good IPC practices, and the other half had poor practices (Osuala & Oluwatosin. 2017:5). They found that there was inadequate infection prevention and control facilities such as a constant supply of running water and electricity, non-availability of taps with sensor and automated hand dryers (Osuala & Oluwatosin, 2017:5).

A number of studies reported that good practice was found to be less than 50%. According to Sarani *et al*. (2016:194), out of the 145 participants, 34 % had a good practice, 42% average, and 24% poor practice of IPC. Those who had better knowledge scores were also found to have good practices (Sarani *et al*., 2016:195).

A study on knowledge, practices, and associated factors towards prevention of SSI among nurses, working in Amhara regional hospital in Northwest Ethiopia, found IPC practices to be inappropriate at 48.7% (Teshager *et al*., 2015:3). They reported that female nurses, those older than 30 years old, and nurses with diplomas, as opposed to a nursing degree, were two times more likely to practice good infection prevention and control (Teshager *et al*., 2015:3).

2.10 Summary

The literature reviewed outlined the role that healthcare workers, particularly nurses, play in IPC. In order to eliminate HAIs, evidence-based practices need to be put in place.

These include standard precaution measures as well as BCA bundles targeted at respective HAIs. However, in order for these to be effective, consistent compliance is of essence. Generally, the literature showed that healthcare workers, particularly in developed countries, have adequate knowledge, a positive attitude toward IPC and practices that complied with their IPC programme. However, in developing countries, most healthcare workers were found to have inadequate knowledge of IPC as a result poor IPC compliance and high HAI rates.

Literature showed there were shortcomings in compliance as healthcare workers were found to have inadequate knowledge of IPC, had a negative attitude towards IPC; good IPC practices were not implemented.

2.11 Conclusion

An overview of the literature on HAIs and nurses' IPC KAP, was presented in this chapter. The research methodology used in this study is covered in the next chapter.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

In this chapter an outline of the methodology is presented in terms of nurses' knowledge, attitude and practices (KAP) of infection prevention and control at a private hospital in Namibia. The aims and objectives and the setting of the study are described. Also covered are the research design, target population and how the sample was selected. In addition, the data collection instrument, as well and the data collection process, are discussed so that replication of the methodology can be done.

3.2 Aim and objectives

Compliance of the IPC programme at the private hospital in this study remains a challenge. Consequently, the rate of HAIs continues to be high. It is for this reason that this study was done in order to investigate the nurses' knowledge, attitude and practices of infection prevention and control to determine how these variables relate to the low compliance with the IPC programme.In order to meet achieve this there were four research objectives.

- To explore nurses' knowledge of infection prevention and control at a private hospital in Namibia.
- To describe nurses' attitudes towards the IPC at a private hospital in Namibia.
- To determine the infection control practices of nurses at a private hospital in Namibia.
- To describe the relationship between the level of knowledge, attitude and infection prevention and control practices at a private hospital in Namibia.

3.3 Study setting

The study was conducted at a 121- bed capacity private hospital in Namibia. The hospital has the following nursing departments.

- Obstetrics and neonatal high-care ward
- Medical and gynaecological wards
- Surgical ward
- Paediatric ward
- Critical care unit (CCU) and neonatal intensive care unit (NICU
- Emergency centre (pilot department)
- Operating theatre

3.4 Research methodology

Research methodology is defined as the entire strategy under which a study is undertaken, from the identification of a research problem to the final plans of data collections (Grove, Burns & Gray 2013:195). To meet the research objectives in this study, a quantitative study design was undertaken.

3.4.1 Research design

Burns and Grove (2011: 253) defined a research design as a blueprint for conducting a study as its purpose is maximising control over factors that can interfere with the validity of research findings.

A quantitative descriptive design was employed in this study. It is a formal, objective, rigorous and systematic process of generating numerical data, which can be used to described new situations, concepts, and examine relationships between variables (Burns & Grove, 2011:34). A descriptive design was chosen as it provides a picture of what happens in a natural setting without manipulation of variables. It can be used to identify problems with current practices or to provide justification for current practices (Burns & Grove, 2011:256). A questionnaire was administered in order to obtain data on nurses' knowledge, attitude and practices (KAP) of infection prevention and control. This was deemed appropriate as similar studies had made use of a quantitative descriptive design to answer similar research questions. In view of this the researcher chose to employ the set design. There were dependent and independent variables in this research study.

3.4.1.1 Dependent variable

A dependent variable is referred to as the consequence or the presumed effect that varies with a change in an independent variable (Lo-Biondo-Wood & Haber 2010:35). For the purpose of this study, the rate of IPC compliance was dependent on the nurses' level of knowledge, their attitude and practices of infection prevention and control. Therefore, the IPC compliance was the dependent variable.

3.4.1.2 Independent variable

An independent variable is one that is presumed to have an effect on a dependent variable (Lo-Biondo-Wood & Haber 2010:34). The knowledge, attitude and practices of IPC were the independent variables in this study as they were presumed to have an effect on IPC compliance.

3.4.2 Population and sampling

A researcher has to determine the population on which a research will be focused. However, it may not be possible to study an entire population, therefore a sampling plan is required to select a sample that will represent the entire target population (Burns & Grove 2011:290). It is vital that the sample contains the same elements as the population in order to ensure generalisation of research findings (Burns & Grove, 2011:291).

3.4.2.1 Population

A target population is a particular group of individuals or elements that are the focus of a study and meet the sampling criteria (Burns & Grove, 2011:290). For the purpose of this study, the target population was all the categories of nurses as defined by the Namibian Nursing Act no 8:2004. The target population was 122 nurses who were employed at the private hospital selected as this study's research site. The population comprised registered nurses (RN), enrolled nurses (EN) and enrolled nurse auxillary (ENA) as shown in Table 3.1 in 3.4.2.2.4 below.

3.4.2.2 Sampling

Sampling is referred to as a process by which a group of people, events, behaviours or other elements that are required to conduct a study are selected (Grove, Burns & Gray, 2013:351). A study sample should meet sampling criteria to ensure representativeness

and generalisation of research findings to the larger population (Grove, Burns & Gray, 2013:253). To ensure representativeness in this study the researcher employed non-probability sampling.

3.4.2.2.1 Non-probability sampling

Non-probability sampling means that not every element of a population has an opportunity to be included (Grove, Burns & Gray, 2013:362). In terms of this study, since there were a limited numbers of potential participants, non-probability sampling ensured that all who met the sampling criteria and were willing to participate could be included in the study (Grove, Burns & Gray, 2013: 362). Convenience sampling was used in this study.

3.4.2.2.2 Convenience sampling

In this study convenience sampling ensured that potential participants are included in this study because they happen to be at the right place at the right time and data are collected until all participants, who met the inclusion criteria, were given a questionnaire to complete (Burns & Grove, 2011:305).

3.4.2.2.3 Sample size

According to Grove, Burns and Gray (2013: 367) a sample, when considering its size, should contain at least 30 participants for each variable to be measured. Given that this study contained three variables, the desired minimum sample size was set at 98 participants. In other words 80% of the target population (n=122). This was the minimal acceptable recommended power that had the capacity to correctly reject the null hypothesis (Grove, Burns & Gray, 2013: 367).

3.4.2.2.4 Estimation of sample

Table 3.1 shows the total population and sample size for each nursing category in this study.

Table 3.1: Total population

Category	Population	Piloted group (%)	Sample
Registered nurses	68	7(10%)	53 (78%)
Enrolled nurses	52	5(10%)	36 (70%)
Enrolled nurse auxiliary	2	0(0%)	1 (50%)
Total:	122	12 (10%)	90 (74)

3.4.2.2.5 Sampling error

Sampling error is the difference between the sample statistic and the parameters of a target population; a larger sampling error indicates poor or low representativeness (Grove, Burns & Gray, 2013:354). In this study, the sampling error was a limitation as not all participants completed the questionnaire as some refused to participate in the study. Furthermore, the researcher tried to include another hospital but was not successful in getting permission from the hospital board.

3.4.2.3 Inclusion criteria

There was one inclusion criterion: all categories of nurses who were working at the selected hospital during this study. The categories included registered nurses (unit managers, senior professional nurses, and professional nurses), enrolled nurses, and auxiliary nurses.

3.4.2.4 Exclusion criteria

There was one exclusion criterion: nurses in administrative positions who were not involved in direct patient care.

3.5 Data collection tool

A data collection tool is an instrument used to collect relevant data to answer the research questions (Jooste 2011:311). It is vital that the instrument is aligned with the research objectives.

In this study the researcher adapted an existing questionnaire to collect data. In the previous study, the Chronbach's alpha was 0.8 (Paudyal, Simkhada & Bruce, 2008). Permission was obtained for the researcher to make necessary alterations in order to ensure that the instrument did suit this study (see Annexure C). The questionnaire comprised four sections with 46 closed-ended questions.

The researcher made a few alterations to the original instrument. This was done in order to include elements of the IPC programme of the hospital in this study. The researcher's academic research supervisor, and a statistician, assessed the changes and agreed they were relevant for this study's setting.

The questionnaire was in English as it is the official language in Namibia. All members of the target population are proficient in the English language.

The four sections of the questionnaire are presented below. Section 1 covered demographics and the other three covered knowledge, attitude and practices (KAP) factors.

3.5.1 Section 1: demographic data

This section covered demographic data: gender, age, level of education, and years of experience. Two statements in the original questionnaire (the number of hours worked per week and number of patients a health worker attends to in one day) were removed because they did not relate to the research objectives of this study. The participants were requested to tick the applicable boxes of the seven closed-ended questions (1.1 to 1.7).

3.5.2 Section 2: knowledge

This section consisted of 14 closed-ended questions (2.1 to 2.14) to obtain data on the nurses' level of knowledge of the IPC programme. The original tool had a 3-point Likert

scale: agree, disagree or uncertain. For this study a 5-point Likert scale was used: strongly agree, agree, uncertain, disagree, and strongly disagree.

The researcher made a few alterations in this section. The original instrument dealt with the inappropriate use of antibiotics. In this study this statement was replaced with a statement drawn from the hospital's infection control programme (2.11) and literature. In order to gain more information on the nurses' knowledge related to the IPC programme, 2.17 and 2.18 were altered to include statements related to the IPC programme.

3.5.3 Section 3:attitude

This section covered the nurses' attitude toward the IPC (3.1 to 3.10). Instead of using the original instrument's 3-point Likert scale, a 5-point Likert scale was used: strongly agree, agree, uncertain, disagree, and strongly disagree to gather a wider range of response options.

Changes were made to 3.1, 3.3, 3.4 and 3.5 to meet the objectives of this study. This was done because the literature related to the attitude of the healthcare workers toward infection control.

3.5.4 Section 4: practices

This section covered IPC practices. A 5-point Likert scale, instead of a 3-point one, was used. The options were: always, regularly, sometimes, rarely, and never. The researcher replaced 4.2 with a statement to cover the hand hygiene audit of the hospital in this study.

3.6 Pilot test

According to Burns and Grove (2011:49) a pilot test is a smaller version of a main research study. It is used to test a research instrument and if necessary, to refine the steps in a research process. A pilot test in this study was conducted in a similar manner in which the actual study was to be undertaken. It was conducted in the emergency department of the research setting, using the questionnaire and data analysis techniques

(Burns & Grove 2011:49). It also allowed the researcher to check the feasibility of the study as well as examine the reliability and validity of the data collection instrument.

The researcher intended to conduct a pilot test at another hospital but permission to do was not granted. The pilot test was therefore conducted in the emergency unit of the private hospital. The venue was the staff room. Seven registered nurses and five enrolled nurses (n=12) agreed to participate in the pilot test. The researcher is an employee at the study site thus a fieldworker was recruited to collect data. The fieldworker is a master's degree graduate nurse hence was familiar with the research process.

The results from the pilot test were not included in the final research data. Cronbach's alpha was 0.5 (moderate reliability) and was re-measured because the researcher did make alterations to the instrument.

3.7 Reliability

The reliability of an instrument is determined by its ability to consistently measure the concepts under study (Burns & Grove, 2011:332). The instrument is this study was adapted from that used in a study on infection control knowledge, attitude and practices amongst Nepalese healthcare workers (Paudyal, Bruce & Simkhada 2008: 595 – 597). Some alterations were made to the instrument to fit to the current research setting. A pilot test was conducted in order to ensure face and content validity, and Cronbach's alpha was used to measure the internal consistency of the instrument. The Cronbach alpha score for the questionnaire of the pilot test was 0.5. The Likert scales questions were adapted for the main study with a follow-up Cronbach alpha score, of 0.618 (moderate reliability). Cronbach's alpha coefficient of 1.00 indicates perfect reliability and 0.00 no reliability (Burns & Grove 2011: 334). Hamed (2016:33) outlined four cut-off points for reliability based on the Cronbach alpha: excellent reliability (0.9 and above high reliability (0.7 – 0.9), moderate reliability (0.5 – 0.7), and low reliability (0.5 and below). Reliability on its own is not sufficient thus it needs to be combined with validity. The low Cronbach may be due a small target population and subsequently a small sample size.

3.8 Validity

According to Burns and Grove (2011:334) validity is the extent to which an instrument accurately reflects the abstract concept under study. A research instrument will never be completely valid; the aim is to measure the degree of validity and not the presence of validity (Hamed, 2016:34). Three types of validity were used to measure the research instrument.

3.8.1 Face validity

This is the extent to which items in a research instrument linguistically look at what is supposed to be measured (Hamed, 2016:34). In addition, face validity evaluates an instrument in terms of feasibility, readability, consistency of style, formatting and clarity of the language used Burns and Grove (2011:334). Face validity in this study was determined during the pilot test. The participants confirmed face validity. An infection control specialist nurse also confirmed face validity.

3.8.2 Content validity

This type of validity examines the extent to which an instrument includes all major elements relevant to the construct under study (Burns & Grove, 2011:335). In order to establish content validity in this study, an extensive literature review was conducted. A research instrument in the literature was adapted to address elements of the IPC programme in this study. The adapted instrument was then validated by an IPC expert at the hospital, the researcher's supervisor and a statistician.

3.8.3 Construct validity

Construct validity, according to Hamed (2016:31), refers to how well a concept, idea or behaviour is translated into an operational reality. It determines cause and effect behaviour in a causal relationship (Hamed 2016:31). The construct validity of the instrument in this study was based on a previous questionnaire, reviewed literature, and the private hospital's infection control programme.

3.9 Data collection

This is the precise, systematic gathering of information relevant to a research purpose (Burns & Grove, 2011:52). The activities related to data collection are discussed below. The discussion includes activities before data collection, the data collection procedure, and after data collection.

3.9.1 Before data collection

Before data collection commenced for pilot testing, and the study, ethical approval from Stellenbosch University Health Research ethics committee was obtained (Appendix A), as well as permission from the private hospital's clinical research ethics committee (Appendix D). Thereafter the researcher and the fieldworker jointly met with the nursing manager and the respective unit managers. The managers were informed during the meeting about the study and the research process. The logistics for data collection were agreed upon. As mentioned above in 3.6 the fieldworker had the required expertise to administer the questionnaire for data collection.

Before data collection commenced the fieldworker informed each participant about the research study. The participants were requested to sign the informed consent form. They were informed of the aims and objectives of the study and that participation was voluntary. They were told that they were free to withdraw from the research study at any time.

3.9.2 Data collection procedure

Grove, Burns and Gray (2013: 507) refer to various modes of data collection. For example, interviews, observations, focus group, self-administered questionnaires or extraction from existing documents. As this was a quantitative research study, a self-administered questionnaire was used to collect data.

The researcher obtained the off-duty rosters from the unit managers of the respective nursing departments to check suitable dates for data collection. Based on these rosters it was decided to administer the questionnaire to participants during the week 4 to 9 June

in 2018. The reason for selecting this week was because most personnel were expected to be on duty. Six nurses were on leave during the period of data collection.

Permission was obtained from the hospital's general manager, and the training department, to use the conference room as the venue for data collection. On the data collection days, the fieldworker spent time in the respective nursing units explaining the research study to the participants. Copies of the information leaflet were distributed in the nursing units for the participants to read through. Those willing to participate in the study then came to the conference room during their break times.

The night duty nursing personnel completed the questionnaire between 07:00 - 09:00 am when their shifts ended. The day shift participants completed the questionnaire at different intervals throughout each day. To ensure continuation of service delivery a minimum of three nurses remained in the units when their colleagues went to complete the questionnaire during their 30 minute tea or one-hour lunch breaks. No undue interruption of normal operations was reported. However, the ICU, and the theatre nurses, respectively, completed the questionnaire at random times throughout the course of the week.

The participants placed their completed consent forms in a box in the venue. They were then handed a copy of the questionnaire to complete. They then put their completed questionnaire in a separate box before exiting the venue. This ensured that no connection could be made between the consent form and the questionnaire. The completed questionaires did not include the names of the pariticipants hence their right to anonimity was adhered to. Table 3.2 is a summary of the data collection process.

Table 3.2: Summary of data collection in 2018

Date	Consent forms received	Questionnaires handed out	Returned questionnaires	Discarded questionnaires
25 May:	12	12	12	Nil
Main study Data Collection				
4 June	25	25	25	2
5 June	15	15	15	1
6 June	25	25	25	0
7 June	19	19	19	2
8 June	10	10	8	2
9 June	3	3	3	0
Total	**97**	**97**	**97**	**7**

A hundred and four (104) Information leaflets and consent forms distributed to the respective nursing departments by the fieldworker during the short information sessions. As shown in Table 3.2 a total of 97 signed consent forms was received; 97 questionnaires were distributed and completed.

A limitation of this study was that there was one data collector who provided information to the participants, and had to prepare the venue early in the morning when the night shift participants came to complete the questionnaire. Due to time constraints a number of nurses on night duty were not prepared to wait until their shifts ended to complete the questionnaire. In addition, during the course of the day, the fieldworker was not able to take comfort breaks. The venue was open at all times to ensure that the participants could complete the questionnaire during their breaks. Seven received questionnaires had to be discarded for various reasons, mainly due to being inadequately completed.

From a total population of 122 nurses, six were on leave of absence during the week of data collection. As stated in 3.6 the completed questionnaires in the pilot test were not included for data analysis and the twelve participants were not eligible to participate in the study. Seven out of the 104 eligible participants did not participate: 97 nurses (93.3%) participated in the study. After data cleaning n = 90 (87%) completed questionnaires were eligible for data analysis.

3.9.3 After data collection

At the end of each day, the researcher received the sealed labelled boxes containing the consent forms and questionnaires from the fieldworker. The consents forms have been stored in a safe in the researcher's home.

On the advice of the statistician, the collected data were coded, cleaned and captured on to a Microsoft Excel spreadsheet. The captured data were cross-checked for accuracy and for any missing data. The spreadsheet was then sent to a Stellenbosch University statistician in the department of biostatistics.

3.10 Data analysis

Data analysis is the process of reducing, organising and giving meaning to that data (Burns & Grove, 2011:52). As stated above the researcher sent the data spreadsheet to the statistician for analysis. The statistician utilised the SPSS version 25 for descriptive and inferential analysis. For this study, frequency and percentage were used to summarise the data. The results are presented in frequency tables and bar and pie charts in the next chapter. Pearson's chi-square was used to test the association between knowledge, attitude and practice (KAP) and potential cofounders. Binary logistic regression was used to identify factors associated with KAP.

3.10.1 Frequency distribution

Frequency distribution is a statistical procedure that involves listing all possible measures of a variable and tallying each datum on the listing (Grove, Burns & Gray, 2013: 694).

3.10.2 Binary logistical regression

Logistic regression is used to predict the relationship between the dependent and the independent variables. Binary or multiple logistic regression is used when there are more then one independent variable (Burns & Grove, 2011: 398).

3.10.3 Chi-square test

This test is used to analyse nominal data to determine significant differences between observed frequencies within the data and frequencies that were expected (Grove, Burns & Gray, 2013: 688). Degrees of freedom are the measurements of the number of values in the statistic that are free to vary without influencing the statistical results (Benac, 2017:n.p). In a chi-square test, degrees of freedom are needed to test the different hypothetical situations as the actual results may vary from the expected (Benac ,2017:n.p). Furthermore, the Hosmer and Lemeshow(HL) test is the goodness of fit test for logistical regression for a risk prediction model (Bartlett, 2014:n.p). The HL test tells one how well the data fit into the model, by calculating whether the observed rates match the expected rates (Bartlett, 2014:n.p).

In addition, Pearson's correlation (r) is used to determine the relationships among the different variables (Burns & Grove, 2011: 543).

3.10.4 P-value: level of statistical significance

This is a probability level where the results of statistical analysis are measured to determine statistically significant differences between the groups: a level of significant of 0.05 or less indicates that the difference between the groups to be significantly different (Burns & Grove, 2011: 377).

3.10.5 Standardised statistics

Standardisation is when different variables are put together on the same scale (Frost, 2019:n.p). This allows for a comparison to be made between the different types of

variables (Frost, 2019:n.p). For the purpose of this study, standardisation was used for the KAP variable to compare the scores in relation to the demographic data.

3.10.6 Z-score

The z-score is measured in standard deviation units and indicates the distance from the mean average. A positive (+) z-score indicates a score higher than the mean average,i.e. standard deviations above the mean, better than average. A negative (-) score indicates a score below the mean average; i.e. standard deviations below the mean less than average (Hayes, 2019:n.p).

3.11 Limitations

3.12 Summary

The methodology and steps followed in the study were presented. Validity and reliability of the research instrument was discussed, including the results obtained from the pilot test and the changes made to the questionnaire. The chapter concluded with a detailed discussion of the data analysis procedures. Data presentation and interpretation of results for the main study are covered in the next chapter.

CHAPTER 4

DATA ANALYSIS AND RESULTS

4.1 Introduction

This chapter provides data analysis and presentation of the findings on the investigation of nurses' knowledge, attitude and practices of infection prevention and control, in relation to the low compliance with the IPC programme at a private hospital in Namibia. The Statistical Package (IBM SPSS version 25) was used for the descriptive statistics. This ensured that the underlying dimensions of the measurement scales achieved an acceptable level of reliability for further analysis.

4.2 Problem statement

According to the IPC reports, there is constant poor compliance with the IPC programme at the private hospital. In order to gain more perspective on the reason for the poor compliance, the aim of this study was to investigate nurses' knowledge, attitude and infection prevention and control (IPC) practices at a private hospital in Namibia.

4.3 Purpose

The purpose of this study was to investigate nurses' knowledge, attitude and practices of infection prevention and control in order to determine how these variables relate to the low compliance with the IPC programme at the private hospital.

4.4 Research design

In order to achieve the set objectives a quantitative approach was used for data collection. A descriptive design was chosen as it provided a picture of what happened in the natural setting without manipulation of the variables. It was used to identify problems with current practices or to provide justification for current practices (Burns & Grove, 2011:256). A closed-ended questionnaire was administered to obtain quantitative data on nurses' knowledge, attitude and practices of infection prevention and control: a quantitative

descriptive design was used. This design had been used in similar studies as discussed in Chapter 2 to answer research questions.

4.5 Data collection technique: questionnaire

An instrument from a study in the literature was adapted to fit this research setting. Permission (Annexure C) was obtained from the original researcher to make necessary alterations in order to ensure that the instrument did well suit this study. A pilot test was conducted and thereafter final changes were made. There were four sections in questionnaire with 46 items. As discussed in 3.5.1 to 3.5.4 in the previous chapter alterations were made to the original instrument so that elements from the private hospital's IPC programme were included to address the objectives of the study. These alterations, as discussed in 3.5 in the previous chapter, were done in consultation with the research supervisor, the IPC expert and the statistician.

4.6 Data preparation

After the data collection process the researcher prepared the data (completed questionnaires) for data analysis. The researcher numbered each returned questionnaire and also checked that all the items have been answered. Seven questionnaires were incomplete thus were excluded in the data analysis process. The final response rate was 86% of the target population. This was an acceptable sample size, as it is above the benchmark of 80 % recommended power that has the capacity to correctly reject the null hypothesis (Grove, Burns & Gray, 2013: 367).

A total of 90 questionnaires were adequately completed and prepared for analysis. The data (n=90 questionnaires) were entered into a Microsoft Excel spreadsheet twice to check that there were no discrepancies in the entries. Thereafter the spreadsheet was forwarded to the statistician employed by the Faculty and Medicine and Health Science of Stellenbosch University for analysis. The statistician recommended regrouping of the age of the participants, nursing categories, years of experience and qualifications, to ensure data richness.

4.7 Research results

Data analysis and results of the four sections of the questionnaire are presented below.

4.7.1 Section 1.Demographic data

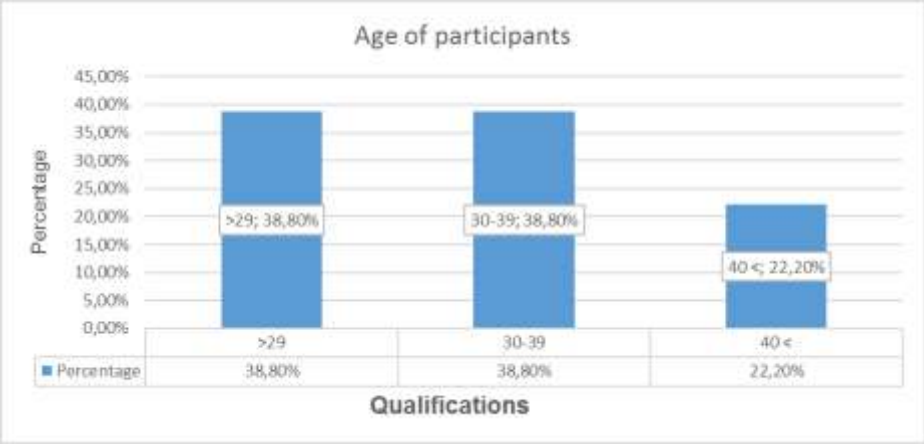
The study aimed to obtain data on the knowledge, attitude and infection prevention and control practices of nurses working in a private hospital in Namibia. The participants were from different nursing departments and included all categories of nursing as per the Nursing Act 8 of 2004.

Section 1 of the questionnaire pertained to demographic data. It consisted of seven questions: age, gender, nursing category, highest qualification, nursing department in which the participants work, length of time working as a nurse, and attendance of IPC training. The Hosmer and Lemeshow test was done with Chi-square p-value 0.23 (df=8) for the seven variables. The variables are presented below.

4.7.1.1 Variable 1.1: age

The majority of participants were from the age group < than 39 years. Table 4.1 shows that the number of participants in the first group (>29 years) and the second group (30 – 39 years) were the same: n = 35 (38.8%). However, the third group (>40 years) was smaller: n = 20 (22.2%). The result is significant as the p-value is 0.003.

Table 4.1: Age of participants (n=90)



4.7.1.2 Variable 1.2: participants' gender distribution

As shown in Figure 4.1 there were more females than males: 94.4% and 5.6%, respectively. The statistical results is not significant as the p-value= 0.268.

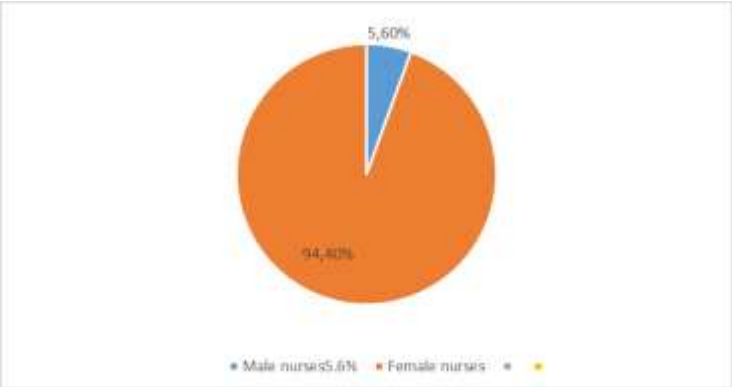


Figure 4.1: Gender distribution of participants (n=90).

4.7.1.3 Variable 1.3: nursing category

As shown in Figure 4.2 the results were: registered nurses n= 44 (48.9); enrolled nurses and enrolled nurse auxiliary n= 37 (41.1%); unit managers n= 5 (5.6%); senior registered nurses n= 4 (4.4%). Irrespective of their category every nurse is duty bound to maintain the health status of a patient under their care in terms of prevention and control of the spread of infection (Government gazette # 2040 1999:3). The result is not significant as the p-value= 0.981.

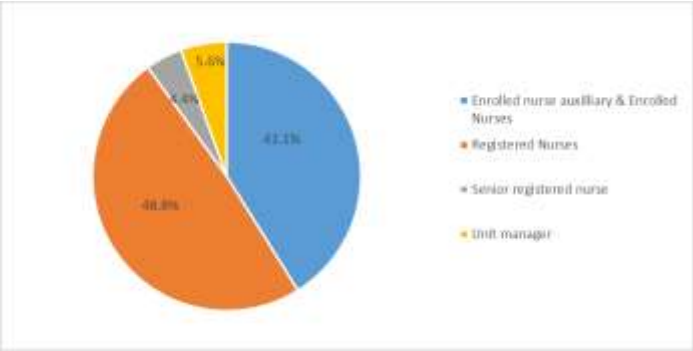


Figure 4.2: Nursing category of participants (n=90).

4.7.1.4 Variable 1.4: highest qualifications

The majority of participants in the private hospital had a certificate qualification including grade 12 as their highest qualification n = 36 (40%), followed by a 3 or 4-year diploma in nursing n=33 (36.7%) as shown in Figure 4.3. These two groups constituted 76.7% of the participants. Just under a quarter n=21 (23, 3%) had a 4-year bachelor's degree in nursing. The statistical results are not significant as the p-value= 0.876.

Figure 4.3: Highest qualification of participants (n=90).

4.7.1.5 Variable 1.5: number of years in practice

Figure 4.4 shows the following in terms of years of practice: 5 – 9 years n= 29 (32.2%); 4 or less years n= 26 (28.9%); 20 or more years n= 20 (22.2%); and 10 -19 years n= 14 (16.6%).

Current evidence-based practices have led to an evolution in IPC practices over the years. Therefore, it is vital that nurses remain abreast of new developments in the field. The statistical results are not significant as the p-value= 0.258.

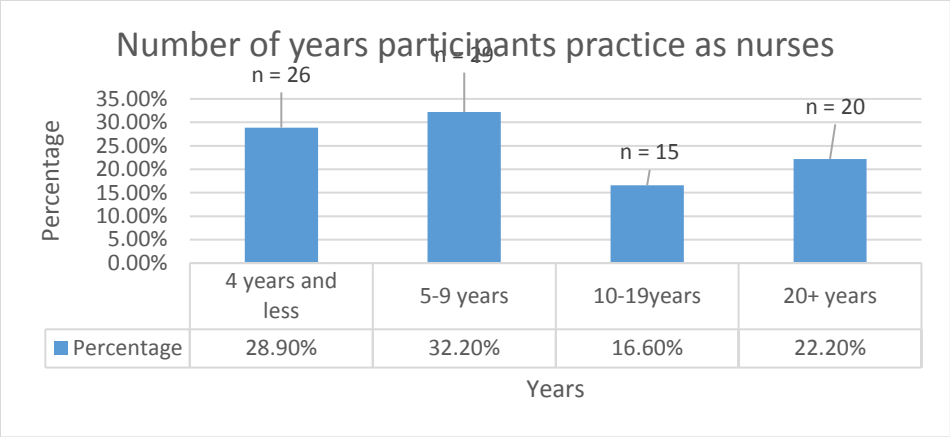


Figure 4.4: Number of years practicing as a nurse (n=90).

4.7.1.6. Variable 1.6: nursing department where the participants worked

The majority of participants were from the surgical ward n= 19 (21.1%), followed by the operation room n=14 (15.6%), adult ICU n= 13 (14.4%), and maternity and paediatric wards n = 11 (12.2%. These results are shown in Figure 4.5. An equal number worked in the emergency and neonatal ICU/high care wards n=9 (10.0%). Very few worked in the medical ward n=4 (4.4%). These percentages are representative of the current personnel distribution in the respective nursing departments. The surgical ward has the biggest bed capacity in the hospital hence it has more nursing personnel compared to other departments.

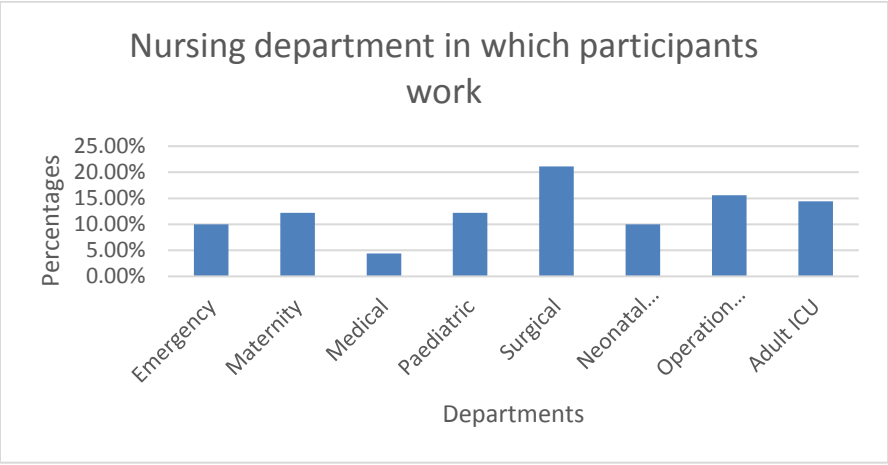


Figure 4.5: Participants' distribution in nursing departments (n=90).

4.7.1.7 Variable 1.7: attended training on hospital IPC

Figure 4.6 indicates that the majority of participants had attended training on hospital infection n= 80 (88.9%). The statistical results are not significant as the p-value= 0.40.

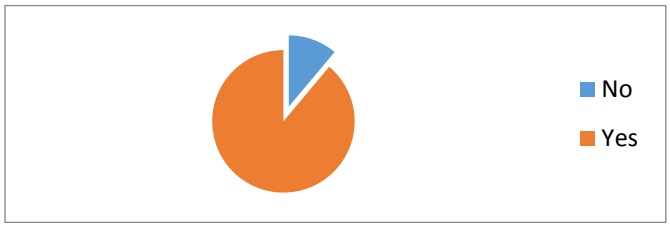


Figure 4.6: Distribution of nurses who attended training on hospital infection prevention and control (n=90).

4.7.2 Section 2. Nurses' knowledge of infection prevention and control programme

The aim of this section was to determine the participants' knowledge of the IPC programme and to answer the first objective, which was aligned with the theoretical framework of knowledge of infection prevention and control. The focus was to determine the participants' knowledge of IPC because in-adequate knowledge is one factor related to poor compliance with the IPC programme.

There were 14 statements related to the IPC programme. A Likert scale was used: agree, disagree, or uncertain of the answers. The participants' response to these statements are presented in Table 4.2 and discussed below.

Table 4.2: Participants' knowledge of infection prevention and control (n=90)

#	Statement	Disagree /uncertain n n (%)	Agree n (%)	Total n (%)
2.1	Healthcare-acquired infections are caused by micro-organisms that can be transmitted between patients by healthcare workers	n =3 (3.3%)	n = 87 (96.7%)	n =90 (100%)

2.2	Healthcare workers are also at risk of getting a healthcare-associated infection	n = 1 (1.1%)	n = 89 (98.8%)	n =90 (100%)
2.3	Compliance with infection control programmes can prevent the Healthcare-associated infection	n=4 (4.4%)	n=86 (95.6%)	n =90 (100%)
2.4	Healthcare workers can sterilize their hands by washing them	n=65 (72.2%)	n=25 (27.8%)	n =90 (100%)
2.5	Invasive devices, such as urinary catheterization, can increase the risk of hospital infection	n=5 (5.6%)	n=85 (94.4%)	n =90 (100%)
2.6	A patient in a critical clinical condition has a higher risk of acquiring healthcare infections	n=7 (7.8%)	n=83 (92.2%)	n =90 (100%)
2.7	Central venous catheters(CVP) should be changed after seven (7) days if necessary	n=16 (17.8%)	n=74 (82.2%)	n =90 (100%)
2.8	Hands should be washed before and after examining the patient	n=4 (4.4%)	n=86 (95.6%)	n =90 (100%)
2.9	Gloves should always be used when coming in contact with patients	n=51 (56.7%)	n=39 (43.3%)	n =90 (100%)
2.10	Hands should only be washed when they are visibly soiled	n=33 (36.7%)	n=57 (63.3%)	n =90 (100%)
2.11	Gloves should be changed between patients	n=6 (6.7%)	n=84 (93.3%)	n =90 (100%)
2.12	The use of gloves, mask and apron reduces the risk of infection	n=9 (10%)	n=81 (90%)	n =90 (100%)

2.13	The patient's urinary catheter bag should always hang lower than the patient's hip	n=2 (2.2%)	n=88 (97.8%)	n =90 (100%)
2.14	All patients undergoing a surgical procedure should have at least 3 (three) chlorhexidine showers pre- operatively	n=30 (33.3%)	n= 60 (66.7%)	n =90 (100%)

4.7.2.1 Variable 2.1: healthcare acquired infections (HAIs) are caused by micro-organisms that can be transmitted between patients by healthcare workers

Table 4.2 shows that the majority of the participants n=87 (96.7%) agreed that the micro-organisms that cause HAIs are transmitted between patients by healthcare workers. Only a very few n=3 (3.3%) did not agree or were not certain that healthcare workers are responsible for the transmission of these pathogens.

4.7.2.2 Variable 2.2: healthcare workers are also at risk of getting a healthcare associated infection

As indicated in Table 4.2 an overwhelming majority n=89 (98.8%) did agree that healthcare workers are also at risk of acquiring HAIs. One n=1 (1.1%) did not agree

4.7.2.3 Variable 2.3: compliance with infection control programme can prevent healthcare-associated infections

As indicated in Table 4.2 almost all of the participants n=86 (95.6%) agreed that compliance with the infection prevention and control programme can prevent the prevalence of HAIs; a few n=4 (4.4%) disagreed or were uncertain of this statement.

4.7.2.4 Variable 2.4: healthcare workers can sterilise their hands by washing them

Table 4.2 shows that the majority of the participants n=65 (72.2%) disagreed or were uncertain that healthcare workers can sterilise their hands by washing them; those in agreement were just over a quarter n=25 (27.8%).

4.7.2.5 Variable 2.5: invasive devices, such as urinary catheterisation, can increase the risk of hospital infection

Table 4.2 indicates that the majority n=85 (94.4%) agreed that invasive devices such as urinary catheterisation increase the risk of a patient acquiring a HAI; only a few n=5 (5.6%) were unsure or uncertain whether the risk of infection increases with the presence of invasive devices.

4.7.2.6 Variable 2.6: a patient in a critical clinical condition has a higher risk of acquiring healthcare infections

As indicated in Table 4.2, the majority of participants n=83 (92.2%) agreed that a patient in a critical clinical condition has a higher risk of acquiring HAIs. On the hand, some n=7 (7.8%) disagreed or were uncertain whether a critical clinical condition increases the risk of HAIs.

4.7.2.7 Variable 2.7: central venous catheters (CVP) should be changed after seven days if necessary

Table 4.2 shows that most participants n=74 (82.2%) agreed that central venous pressure catheters (CVP) should be changed after seven days if necessary; the remainder n=16 (17.8%) disagreed or were uncertain on the frequency at which a CVP line should be changed.

4.7.2.8 Variable 2.8: hands should be washed before and after examining a patient

As indicated in Table 4.2 the majority of the participants n=86 (95.6%) agreed that healthcare workers should wash their hands before and after examining a patient. However, a few n=4 (4.4%) disagreed or were uncertain about washing hands before and after examining a patient.

4.7.2.9 Variable 2.9: gloves should always be used when coming in contact with patients

As shown in Table 4.2, more than half of the participants n=51 (56.7%), disagreed or were uncertain as to whether gloves should always be used when coming in contact with a

patient. The remainder n=39 (43.3%) agreed with using gloves each time a healthcare worker comes in contact with a patient.

4.7.2.10 Variable 2.10: hands should only be washed when they are visibly soiled

Table 4.2 shows that the majority of the participants n=57 (63.3%) agreed that healthcare workers should only wash their hands when visibly soiled; more than a third n=33 (36.7%) disagreed or were uncertain of washing only visibly soiled hands.

4.7.2.11 Variable 2.11: gloves should be changed between patients

As indicated in Table 4.2 most participants n=84 (93.3%) agreed that gloves should be changed between patients; a few n=6 (6.7%) disagreed or were uncertain whether to change gloves between patients.

4.7.2.12 Variable 2.12: the use of gloves, mask and apron reduces the risk of infection

As shown in Table 4.2 the majority of the participants n=81 (90%) agreed that using personal protective equipment (PPE) such as gloves, masks and aprons does reduce the risk infection. Nonetheless, there were some n=9 (10%) who disagreed or were uncertain on the ability of PPE to reduce the risk of infection.

4.7.2.13 Variable 2.13: a patient's urinary catheter bag should always hang lower than a patient's hip

As seen in Table 4.2 the majority of participants n=88 (97.8%) supported the statement that a patient's urinary catheter bag should always hang lower than the hip. Very few n=2 (2.2%) disagreed or were not sure where this bag should hang in relation to a patient's hip.

4.7.2.14 Variable 2.14: all patients undergoing a surgical procedure should have at least three chlorhexidine showers pre-operatively

As indicated in Table 4.2 two-thirds of the participants n=60 (66.7%) agreed that a patient booked for a surgical procedure should have three chlorhexidine showers pre-operatively;

the other third n=30 (33.3%) disagreed or were uncertain about preoperative chlorhexidine showers.

4.7.2.15 Overall scores of nurses' knowledge of the IPC

The scores of the questions on the nurses' knowledge were added up and an average percentage was calculated and is presented in Table 4.3. Adequate knowledge: 75% and more; and < 75% is considered inadequate knowledge (Tiruneh & Ayele 2018:5)

Table 4.3 Scores of participants' knowledge of the IPC

Nurses' knowledge					
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Inadequate	18	20.0	20.0	20.0
	Adequate	72	80.0	80.0	100.0
	Total	90	100.0	100.0	

As illustrated in Table 4.3 the majority of participants n=72 (80%) had adequate knowledge of IPC. The remainder n=18 (20%) did not.

Lack of knowledge was highest in the statements that covered sterilisation of hands, wearing of gloves, and chlorhexidine showers pre-operative. There were no 100% correct replies to all of the knowledge questions.

4.7.3 Section 3. Nurses' attitude towards the infection prevention and control programmer

This section relates to objective two. The focus was determining the nurses' attitude towards the IPC programme and there were 10 statements. As shown in Table 4.4 a 3-point Likert scale was used.

Table 4.4: Participants' attitude towards the infection prevention and control programme (n=90)

#	Statement	Disagree/uncertain n(%)	Agree n(%)	Total n(%)
3.1	The infection control programme gives healthcare workers additional work while they are already busy with the patient care	n= 23 (25.6%)	n=67 (74.4%)	n =90 (100%)
3.2	It is necessary for health professionals to know whether a patient has an infectious disease	n=6 (6.7%)	n=84 (93.3%)	n =90 (100%)
3.3	Doing an aseptic procedure according to the manual takes up too much time	n=20 (22.2%)	n=70 (77.8%)	n =90 (100%)
3.4	Infection control procedures should only be followed when working with a patient with an infectious disease	n=14 (15.6%)	n=76 (84.4%)	n =90 (100%)
3.5	The fear of health professionals of being infected by an infectious patient is understandable	n=27 (30.0%)	n=63 (70.0%)	n =90 (100%)
	Routine hand decontamination (e.g. hand washing) reduces the risk of infection in patients	n= 5 (5.6%)	n= 85 (94.4%)	n =90 (100%)
3.7	Hand decontamination between each patient protects both staff and patients	n = 3 (3.3%)	n = 87 (96.7%)	n =90 (100%)
3.8	Advice should be given to patient and visitors about prevention and transmission of hospital acquired infection	n = 1 (1.1%)	n = 89 (98.9%)	n =90 (100%)

3.9	I only follow the infection the infection control programme when my supervisor is watching me	n = 11 (12.2%)	n = 79 (87.9%)	n =90 (100%)
3.10	Infection control training is important	n = 3 (3.3%)	n = 87 (96.7%)	n =90 (100%)

4.7.3.1 Variable 3.1: the infection control programmer gives healthcare workers additional work while they are already busy with patient care

As shown in Table 4.4 most participants n=67 (74.4%) agreed that the IPC programme results in additional workload for healthcare workers while they are already busy with patient care. The others n=23 (25.6%) disagreed or were uncertain about whether the compliance with the IPC programme increases a nurse's workload.

4.7.3.2 Variable 3.2: it is necessary for health professionals to know whether a patient has an infectious disease

As indicated in Table 4.4 the majority of participants n=84 (93.3%) agreed that it is necessary for healthcare professionals to know whether a patient has an infectious disease; the others n=6 (6.7%) disagreed or were uncertain.

4.7.3.3 Variable 3.3: doing an aseptic procedure according to the procedure manual takes up too much time

As indicated in Table 4.4 most of the participants n=70 (77.8%) agreed that doing an aseptic procedure as per the guideline in the manual takes up too much time. However, some n=20 (22.2%) disagreed that following the guideline is time-consuming.

4.7.3.4 Variable 3.4: infection control procedures should only be followed when working with a patient with an infectious disease

Table 4.4 shows the majority of the participants n=76 (84.4%) agreed that infection prevention and control should only be followed when a nurse is working with a patient with an infectious disease; the others n=14(15.6%) disagreed or were uncertain of this.

4.7.3. 5 Variable 3.5: the fear of health professionals of being infected by an

infectious patient is understandable

As indicated in Table 4.4 the majority of the participants n=63 (70%) agreed it was understandable that health professionals do fear being infected. On the other hand, some participants n=27 (30%) disagreed or were uncertain on whether such a fear was rational.

4.7.3.6 Variable 3.6: routine hand decontamination (e.g. hand washing) reduces the risk of infection in patients

As shown in Table 4.4 the majority of participants n=85 (94.4%) agreed that routine hand decontamination reduces the risk of infection to patients. However, some n=5 (5.6%) disagreed or were uncertain of how routine decontamination can reduce the risk of infection to patients.

4.7.3.7 Variable 3.7: hand decontamination between each patient protects both staff and patients

With reference to Table 4.4 the majority of participants n=87 (96.7%) agreed that decontamination of hands between each patient can protect both patients and staff from infection. The rest n=3 (3.3%) disagreed or were uncertain.

4.7.3.8 Variable 3.8: advice should be given to patients and visitors about prevention and transmission of hospital acquired infection

As shown in Table 4.4 the majority of participants n=89 (98.9%) agreed that patients and visitors should be given advice on the prevention and transmission of HAIs. One n=1 (1.1%) participants) disagreed or was uncertain.

4.7.3.9 Variable 3.9: I only follow the infection control program when my supervisor is watching me

As indicated in Table 4.4 most of the participants n=79 (87.9%) agreed that they only follow the IPC programme when their supervisor is watching them. There were some n =11 (12.2%) who disagreed or were uncertain of only following the IPC programme when being watched by their supervisor.

4.7.3.10 Variable 3.10: infection control training is important

The majority of participants, as shown in Table 4.4, agreed that infection control training is important n=87 (96.7%); the rest n=3 (3.3%) did not see the value or were uncertain of training in IPC.

4.7.3.11 Overall scores of nurses' attitude toward the IPC programme

The scores for the questions presented above added p and total percentages were calculated as presented in Table 4.5 below. A 75% or more score for attitude section indicates a positive attitude while a score of < 75% is considered a negative attitude (Tiruneh & Ayele 2018: 5).

Table 4.5: Scores of nurses' attitude toward the IPC programme

Nurses' attitude					
		Frequency	Percent	Valid percent	Cumulative percent
Valid	Negative	14	15.6	15.6	15.6
	Positive	76	84.4	84.4	100.0
	Total	90	100.0	100.0	

As shown in Table 4.5 most participants n=76 (84.4%) had a positive attitude toward IPC; the rest n=14 (15.6%) had a negative attitude towards IPC. Negative attitudes were mostly towards the IPC as additional work, timeous aseptic procedure, following IPC procedures only on patients with infectious diseases, fear of being infected, and that nurses only follow the IPC programme when their supervisor is watching them.

4.7.4 Section 4. Nurses' infection prevention and control practices

This final section of the questionnaire was aimed at addressing objective three, which pertained to infection prevention and control practices at the private hospital. A Likert scale (never, rarely, regularly or always) was used for 15 questions regarding nurses' IPC practices. The participants answered all the questions as shown in in Table 4.6.

Table 4.6: The participants' (n=90) responses on infection prevention and control practices

#	Statement	Never/ Rarely n (%)	Regularly/ Always n (%)	Total n (%)
4.1	I wash my hand before, and after every time I come into contact with a patient	n = 14 (15.6%)	n = 76 (84.4%)	n =90 (100%)
4.2	I decontaminate my hand each time I come in contact with the patient's environment	n = 8 (8.9%)	n = 82 (91.1%)	n =90 (100%)
4.3	I wear gloves whenever there is a possibility of exposure to blood or other body fluids	n = 8 (8.9%)	n = 82 (91.1%)	n =90 (100%)
4.4	I wash my hands after removing disposable gloves	n = 21 (23.3%)	n = 69 (76.7%)	n =90 (100%)
4.5	I wear a waterproof apron whenever there is possibility of blood or other body fluids splashing on my clothes	n = 36 (40.0%)	n = 54 (60.0%)	n =90 (100%)
4.6	I wear a mask on my face whenever there is possibility of blood or other body fluid splashing	n = 43 (47.8%)	n = 47 (52.2%)	n =90 (100%)
4.7	I wear a clean washed uniform every day	n = 85 (94.4%)	n = 5 (5.6%)	n =90 (100%)
4.8	I dispose of all the contaminated items into a red disposal bag.	n = 2 (2.2%)	n =88 (97.8%)	n =90 (100%)
4.9	I immediately wipe up all spills of blood and any other body fluids	n = 8 (8.9%)	n = 82 (91.1%)	n =90 (100%)
4.10	I cover my broken skin before coming to work.	n = 13 (14.4%)	n = 77 (85.6%)	n =90 (100%)
4.11	I change my usual care if the patient has infectious disease	n = 16 (17.8%)	n = 74 (82.2%)	n =90 (100%)
4.12	I wear gloves each time when I am required to	n = 8 (8.9%)	n = 82 (91.1%)	n =90 (100%)

4.13	I protect myself against the blood and body fluids of all patients, regardless of their diagnosis	n = 8 (8.9%)	n = 82 (91.1%)	n =90 (100%)
4.14	I put used needles and other sharp objects into the designated sharp container	n = 0 (0.0%)	n = 90 (100.0%)	n =90 (100%)
4.15	I always recap used needles	n = 26 (28.9%)	n = 64 (71.1%)	n =90 (100%)

4.7.4.1 Variable 4.1: I wash my hand before, and after every time I come into contact with a patient

As illustrated in Table 4.6 most of the participants n=76 (84.4%) indicated that they regularly or always wash their hands before and after every time they come in contact with a patient; the rest n=14 (15.6%) indicated that they never or rarely wash their hand before and after every contact with a patient.

4.7.4.2 Variable 4.2: I decontaminate my hand each time come in contact with a patient's environment

The data presented in Table 4.6 show that the majority of the participants n=82 (91.1%) stated that they regularly or always decontaminate their hands each time they come in contact with a patient's environment. However, a small number n=8 (8.9%) stated that they never or rarely did so.

4.7.4. 3 Variable 4.3: I wear gloves whenever there is possibility of exposure to blood or other body fluids

Table 4.6 shows that the majority of the participants n=82 (91.1%) stated they do regularly or always wear gloves whenever there is a possibility of exposure to blood or other bodily fluids. However, a small number n=8 (8.9%) stated that they never or rarely wear gloves even when there is a risk of exposure to blood and bodily fluids.

4.7.4. 4 Variable 4.4: I wash my hands after removing disposable gloves

The data presented in table 4.6, indicate that the majority of the participants n= 69 (76.7%) regularly or always wash their hands after removing disposable gloves, while n=21 (23.3%) never or rarely do.

4.7.4.5 Variable 4.5: I wear a waterproof apron whenever there is possibility of blood or other body fluids splashing on my clothes

The majority of participants n=54 (60.0%), shown in Table 4.6, stated that they do wear a waterproof apron whenever there is a possibility of blood and other body fluids splashing on their clothes. There were some n=36 (40.0%) that disagreed and stated they never or rarely did so.

4.7.4.6 Variable 4.6: I wear a mask on my face whenever there is possibility of blood or other body fluid splashing

As shown in Table 4.6 just over half of the participants n=47 (52.2%) agreed that they always or regularly wear a face mask, but the rest n=43 (47%) stated that even when there is the risk of splashing, they rarely or never wear a face mask.

4.7.4.7 Variable 4.7: I wear a clean washed uniform every day

The data in Table 4.6 show that very few participants n=5 95.6%) agreed that they always or regularly wear a clean washed uniform every day; the majority n=85 (94.4%) indicated that they rarely or never did so.

4.7.4.8 Variable 4.8: I dispose of all the contaminated items into a red disposal bag

The majority of the participants n=88 (97.8%), as shown in Table 4.6, indicated that they always or regularly dispose of contaminated items in the red disposal bag; only two (2.2%) indicated that they rarely or never dispose of contaminated items in the red disposal bag.

4.7.4.9 Variable 4.9: I immediately wipe up all spills of blood and any other body

fluids

Table 4.6 illustrates that the majority of the participants n=82 (91.1%) stated that they always or regularly wipe up any spills of blood or other body fluids immediately; the rest n=8 (8.9%) said they rarely or never did this immediately.

4.7.4.10 Variable 4.10: I cover my broken skin before coming to work

As indicated in Table 4.6 the majority of the participants n=77 (85.6%) stated that they always or regularly cover any broken skin before coming to work. However, some n=13 (14.4%) disagreed and said they rarely or never cover any broken skin before they come to work.

4.7.4.11 Variable 4.11: I change my usual care if a patient has an infectious disease

As indicated in Table 4.6 most participants n=74 (82.2%) agreed that they regularly or always change their routine care when they know that the patient they are working with has an infectious disease. The rest n=16 (17.8%) disagreed and said they rarely or never changed their routine care in such a situation.

4.7.4.12 Variable 4.12: I wear gloves each time when I am required to

The majority of participants, as shown in Table 4.6 n=82 (91.1%), stated that they always or regularly wear gloves each time that they are required to; a few n=8 (8.9%) disagreed that they that routinely adhere to this IPC standard.

4.7.4.13 Variable 4.13: I protect myself against the blood and body fluids of all patients, regardless of their diagnosis

The results for this question, as shown in Table 4.6, are as follows: n=82 (91.1%) stated that they always or regularly protect themselves against blood and bodily fluid of all patients regardless of their diagnosis, and n=8 (8.9%) stated that they do not always or rarely protect themselves from blood and bodily fluids of all patients regardless of what a patient's diagnosis is.

4.7.4.14 Variable 4.14: I put used needles and other sharp objects into the designated sharps container

All of the participants n=90 (100%), as shown in Table 4.6, agreed that they always or regularly dispose of all used needles and sharp objects into designated sharps container.

4.7.4.15 Variable 4.15: I always recap used needles

As illustrated in Table 4.6, most participants n=64 (71.1%) said they always or regularly recap used needles; the rest n=26 (28.9%) disagreed and stated that they rarely or never recap used needles.

4.7.4.16 Overall scores of nurses' IPC practices

The scores for the questions on nurses' IPC practice are presented in Table 4.7. Nurses should score 80% and more to be considered as being compliant with the IPC practices. Any score of less than 80% is regarded as non-compliant IPC practices (Tiruneh & Ayele 2018: 5).

Table 4.7: Scores of nurses' IPC practices

Nurses' practice					
		Frequency	Percent	Valid Percent	Cumulative percent
Valid	Non-compliant	54	60.0	60.0	60.0
	Compliant	36	40.0	40.0	100.0
	Total	90	100.0	100.0	

The majority of participants n=56 (60%), as shown in Table 4.7, adhered to good IPC practices; the IPC practices of others n=36 (40%) was poor. All of the participants adhere to putting needles and other sharp objects into a designated sharp container.

The non-compliance results pertain to (i) hands not being washed after removing gloves, (ii) failure to wear a waterproof apron despite their being a possibility of splashing with blood or other body fluid, (iii) a clean washed uniform is not routinely worn, (iv) failure to always broken skin when on duty, and (v) recapping of used needles as this could result in infection due to needle prick injuries.

4.8 Results on nurses' knowledge, attitude and practice of infection prevention and control in the private hospital in Namibia

Table 4.8 presents the results of nurses' KAP about infection prevention and control.

Table 4.8: Nurses' knowledge, attitude and practice of infection prevention and control

Characteristics	Frequency	Percent (%)
Knowledge		
Knowledgeable	72	80
Not knowledgeable	18	20
Attitude		
Positive attitude	76	84.4
Negative attitude	14	15.6
Practice		
Compliant	36	40
Non-compliant	54	60

4.8.1 Knowledge

The results in Table 4.8 show that 80% of the nurses were knowledgeable in terms of infection prevention and control in the private hospital, and 20% were not knowledgeable.

4.8.2 Attitude

As shown in Table 4.8 the majority participants (84.4%) had a positive attitude towards IPC in the private hospital in this study.

4.8.3 Practices

Only n=35 (40%) of the participants, as shown in Table 4.8, displayed good IPC practices. Poor practice was evident in the rest n=54 (60%) of the n=90 participants.

4.9 Binary logistic regression analysis

In order to identify the relationship between variables (objective four), binary logistic regression analysis was used. For the purpose of this study, knowledge, attitude and practice were the dependant variables, while training on hospital IPC, highest qualification, age, years in practice and gender were the independent variables.

Furthermore, level knowledge was an independent variable for attitude, and both level of knowledge and attitude were independent variables for practice. This was to ascertain the odd ratio between this variables. The odd ratio is the ratio between the dependent and the independent variable. The greater the ration the greater the effect the independent variables has on the dependent variable (Grupa & Sopjani 2017: 85).

4.9.1 Binary logistic regression of factors associated with nurses' level of knowledge on IPC

According to table 4.9 below, receiving training in hospital IPC has an effect on the nurses' level of knowledge of IPC OR = 0.357 (95%CI 0.59 – 2.159). Furthermore, the highest qualification has a great effect on the nurses' level of knowledge, nursing certificate OR = 4.015 (95%CI 0.733 – 22.010) and diploma in nursing OR = 1.873 (95% CI 0.345 – 10.180). The age of the participant significantly effects the level of knowledge p = 0.003. With the age of 30 – 39 years found to have a greatest impact on the level of knowledge OR = 0.419 (95% CI 0.34 – 5.100). This is followed by the years in practice which also affect the level of knowledge of IPC OR = 1.261 (95% CI 0.185 – 8.602).

Table 4.9: Binary logistic regression for Knowledge

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Those who attended training on hospital infection	-1.031	.919	1.260	1	.262	.357	.059	2.159
	Highest qualifications			2.569	2	.277			
	Nursing certificate	1.390	.868	2.565	1	.109	4.015	.733	22.010
	Diploma in Nursing	.628	.864	.528	1	.468	1.873	.345	10.180
	Age			11.369	2	.003			
	29 years or younger	-2.978	1.173	6.444	1	.011	.051	.005	.507
	30 – 39	-.870	1.275	.466	1	.495	.419	.034	5.100
	Years in practice			4.721	3	.193			
	4 years or less	-1.571	.993	2.502	1	.114	.208	.030	1.456
	5 – 9 years	.232	.980	.056	1	.813	1.261	.185	8.602
	10 – 19 years	-1.083	.998	1.179	1	.278	.338	.048	2.392
	Male	-.181	1.147	.025	1	.874	.834	.088	7.896
	Constant	3.339	1.318	6.422	1	.011	28.202		

a. Variable(s) entered on step 1: Attended training on hosp infection, Highest qualifications, Age, Years in practice, Gender.

4.9.2 Binary logistic regression of factors associated with nurses' attitude towards IPC

According to table 4.10 below, the qualification of the nurses have an effect on their attitude towards IPC. Nursing certificate OR = 3.350 (95% CI 0.522 – 21.504, while the Diploma in nursing OR = 0.738 (95% CI 0.147 – 3.699). In addition, the study found the years in practice to affect the attitude towards IPC, 5 – 9 years in practice OR = 0.778 (95% CI 0.122 – 4.974). The training on hospital IPC was found to affect the nurses' attitude towards IPC OR = 0.778 (95% CI 0.122 – 4.974). Finally the study found a significant relationship between the nurses' level of knowledge and their attitude towards IPC p = 0.09 OR = 0.168 (95% CI 0.44 – 0.643).

Table 4.10 Binary Logistic Regression for Attitude

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Highest qualifications			2.636	2	.268			
	Nursing certificate	1.209	.949	1.624	1	.203	3.350	.522	21.504
	Diploma in Nursing	-.304	.822	.137	1	.712	.738	.147	3.699
	Years in practice			3.322	3	.345			
	4 years and less	-.951	1.144	.692	1	.405	.386	.041	3.634
	5 – 9 years	-.231	1.037	.050	1	.824	.794	.104	6.055
	10 – 19 years	-1.533	1.000	2.349	1	.125	.216	.030	1.533
	Those who attended training on hospital infection	-.251	.947	.071	1	.791	.778	.122	4.974
	Adequate knowledge	-1.784	.685	6.778	1	.009	.168	.044	.643
	Constant	2.741	1.055	6.749	1	.009	15.505		

a. Variable(s) entered on step 1: Highest qualifications, Years in practice, Attended training on hospital infection, Nurses' Knowledge.

4.9.2.1 Participants' attitude towards infection prevention and control related to their age

The results in Figure 4.7 indicate that most of the nurses had a positive attitude n=76 (84.4%) in terms of their age. Participants in the age group 30-39 years n=35 (38.9%) were more positive n=31 (34 %) towards IPC than the other age groups. The results further indicate that participants in the younger age group of less than 30 years n=35 (38.9%) were most negative n=10 (11.1%) towards IPC.

Pearson's Chi-square with p-value=0.013 (df=2) shows that attitude has an association with age. All participants in the over 40 year old age category had a positive attitude n=20 (22.2%) towards infection prevention and control. The standardised statistic is positive: above average (z=2.903).

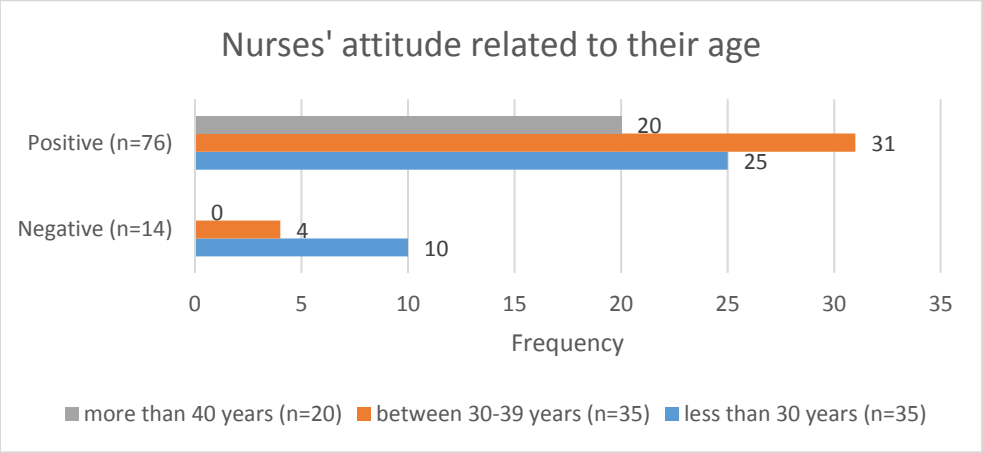


Figure 4.7: Nurses' attitude related to their age.

4.9.2.2 Nurses' attitude related to their nursing category

Figure 4.8 shows the following. All unit managers n=5 (100%) and all of the senior registered nurses n=4 (100%) had a positive attitude towards IPC; most registered nurses n=33 (75%) had a positive attitude towards IPC, but a quarter n=11 (25%) did not have a positive attitude. The majority of nurses in the lower nursing categories, i.e. enrolled and enrolled nurse auxiliary n=34 (92%), had a positive attitude towards IPC; the rest n=3

(8%) did not. The nursing categories were not statistically associated with attitude (p=0.302).

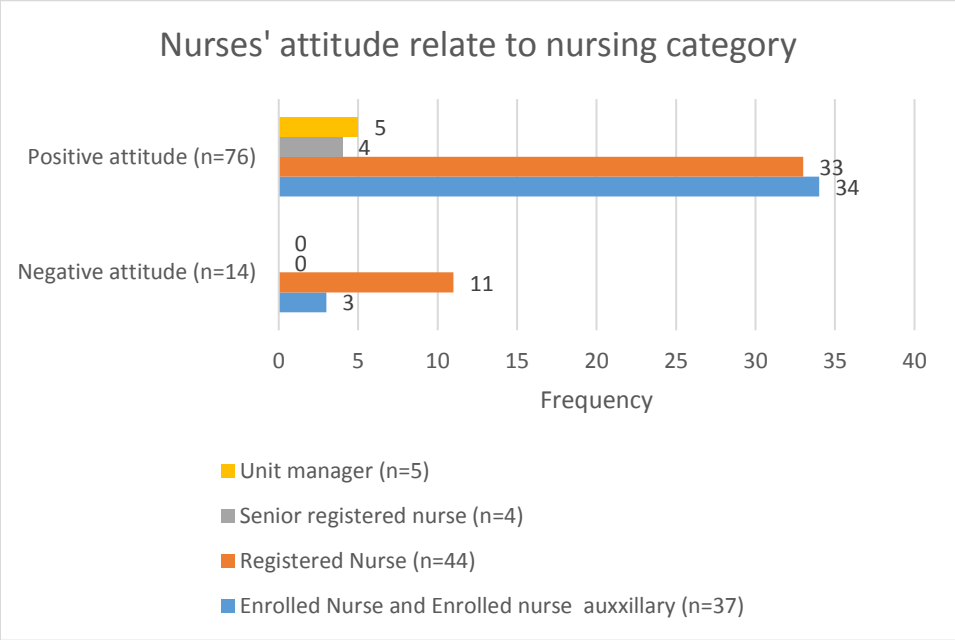


Figure 4.8: Nurses' attitude related to their nursing category.

4.9.2.3 Nurses' attitude related to highest qualifications

The results in Figure 4.9 show the following: nurses with a certificate in nursing, including grade 12, n=33 (91.6%) were the most positive towards IPC; followed by those with a bachelor's degree in nursing n=17 (80.1%), and then a diploma in nursing n=26 (78.8%). The results are not significant as the p-value=0.297 (df=2). The standardised statistic is negative, below average (z=-1.239).

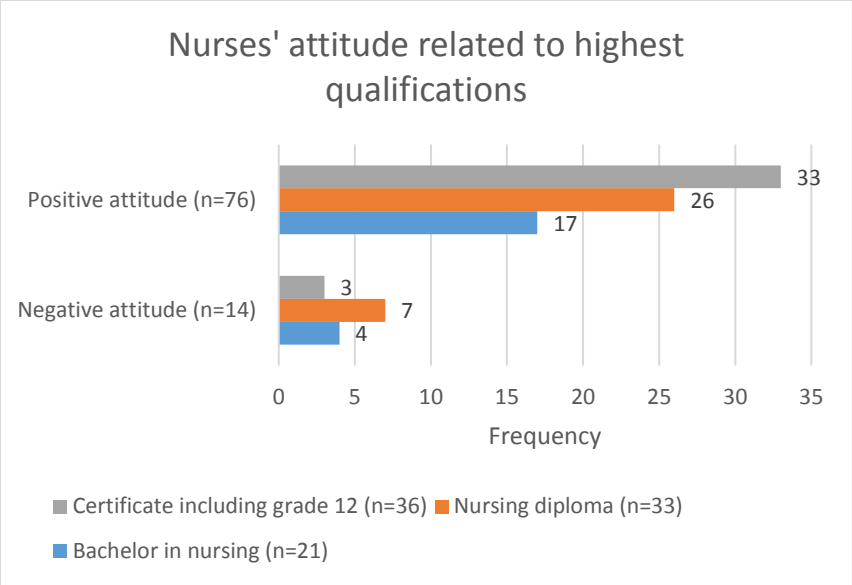


Figure 4.9: Nurses' attitude related to highest qualifications.

4.9.2.4 Nurses' attitude related to years in practice

As shown in Figure 4.10 the majority of nurses that participated in this study had a positive attitude n=76 (84.4%) towards IPC in the private hospital; the rest n=14 (15.6%) did not. From the sample, there were n=26 (28.9%) nurses who had been in practice for 4 years and less, of which n=22 (84.6%) were found to have a positive attitude towards IPC; the rest n=4 (15.4%) did not. Out of those who had been practicing nursing for 5 to 9 years n=29 (32.2%) the majority n=26 (89.7%) had a positive attitude toward IPC; the rest n=3 (10.3%) did not. In terms of those with 10 to 19 years nursing practice n=15 (16.7%) only n=10 (66.6%) had a positive attitude towards IPC; the rest n=5 (33.3%) did not. In terms of those with 20 or more years of nursing experience practice n=20 (22.2%), most n=19 (90%) had a positive attitude towards IPC; the rest n =2 (10%) did not. The result is not statistically significant as the p-value=0.197(df=3). The standardised statistic is positive, above average (z=0.122)

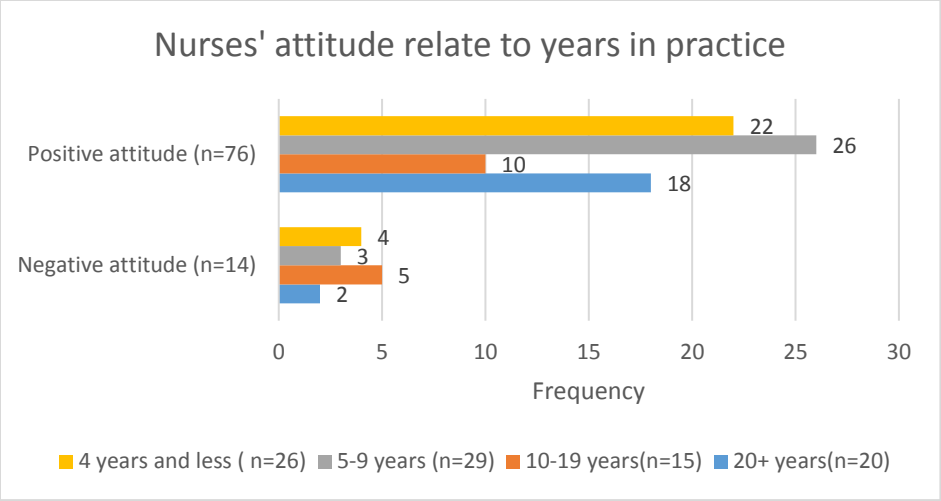


Figure 4.10: Nurses' attitude related to years in practice.

4.9.2.5 Nurses' attitude related to attending training

The results in Figure 4.11 show that the majority of participants n=80 (88.9%) had attended training on hospital IPC, and most n=68 (85%) had a positive attitude towards IPC whereas the rest n=12 (15%) did not. In contrast, out of those who had not or did not know if they had attended training on IPC n=10 (11.1%), the majority n=8 (80%) had a positive attitude towards IPC; the rest did not n=2 (20%). The statistical result is not significant as the p-value =0.681 (df=1). The standardised statistic is positive, above average (z=0.409)

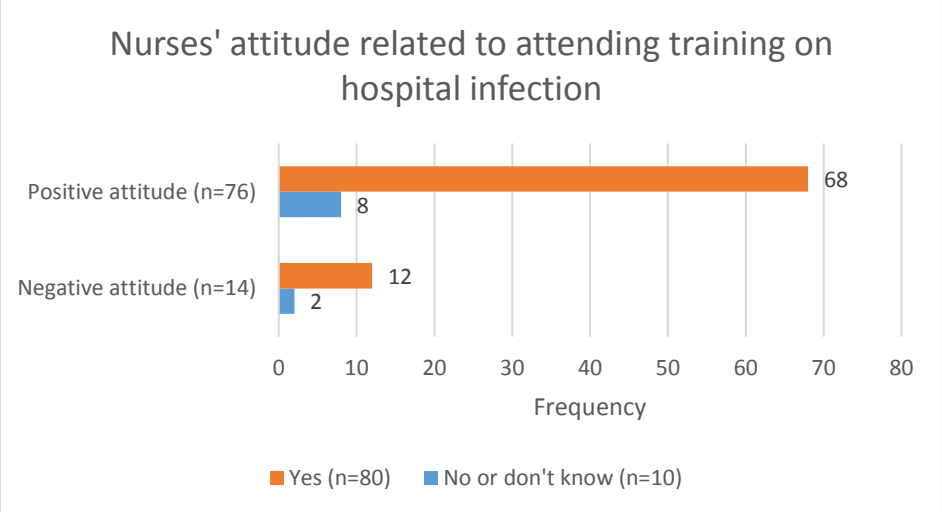


Figure 4.11: Nurses' attitude related to attending training.

4.9.2.6 Nurses' attitude related to gender

Figure 4.12 shows the majority of participants were females n=85 (94.5%) and that the majority of n=72 (84.7%) had a positive attitude towards IPC; the rest n=13 (15.3%) did not. Male nurses constituted 5.5% of the participants: n=5 out of n=90, and the majority of them n=4 (80%) had a positive attitude toward IPC; only one n=1 (20%) did not. The statistical result is not significant as the p-value =0.778 (df=1). The standardised statistic is positive, above average (z=0.281).

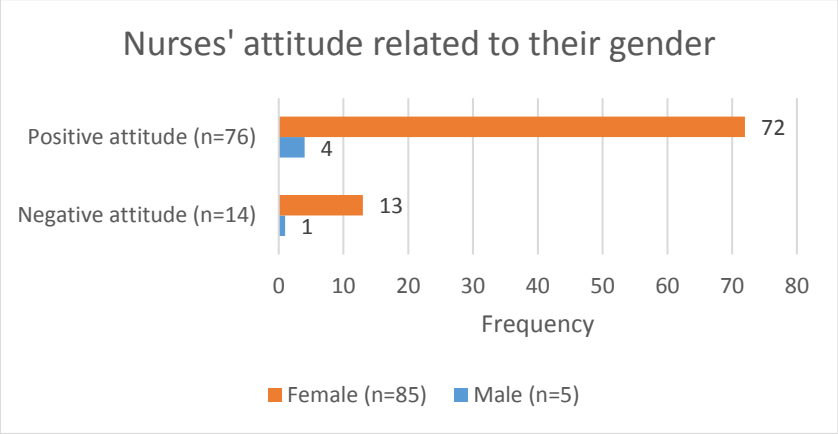


Figure 4.12: Nurses' attitude related to gender.

4.9.2.7 Nurses' attitude related to their knowledge of infection prevention and control

As shown in Figure 4.13 the majority of participants n=72 (80%) had adequate knowledge of IPC, and out of these the majority n=65 (90.3%) had a positive attitude; some n=7 (9.7%) had a negative attitude towards IPC. In terms of knowledge, the results were that there were participants n=18 (20%) who did not have adequate knowledge of IPC but the majority of them n=11 (61.1%) had a positive attitude towards IPC and the rest n=7 (38.9%) did not. These results are statistical significance as the p-value = 0.002 (df=1). The standardised statistic is positive, far above average (z=3.037).

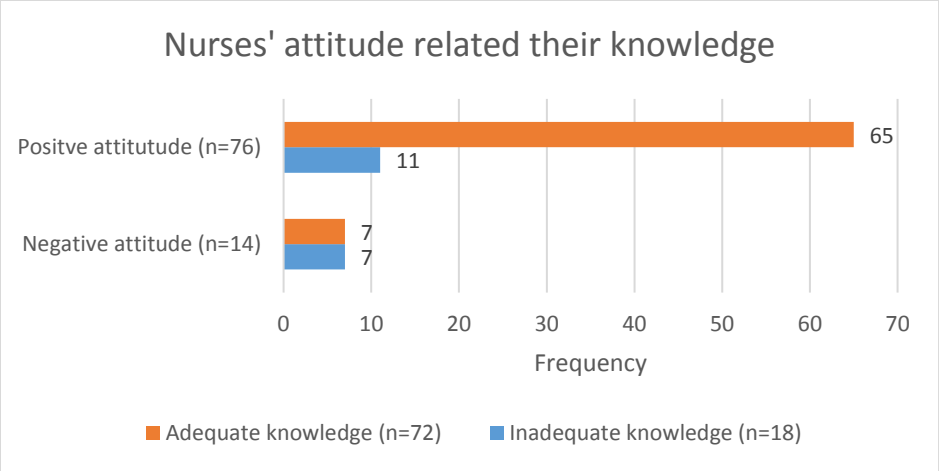


Figure 4.13: Nurses' attitude related to their knowledge of IPC.

Of note is that only age, nursing category, and knowledge, were associated with attitude in terms of the uni-variate analysis of age, gender, nursing category, highest qualification, years in practice, and training on hospital infection,

4.9.3 Binary logistic regression of factors associated with nurses' IPC practices

A binary logistic regression was carried out to determine the factors related to the nurses' IPC practice. According to table 4.11 below, highest qualification of the nurses was found to have an effect on the nurses compliance with IPC Diploma in nursing OR = 1.475 (95% CI 0.375 – 6. 178). In addition, the years in practice were also found to affect the nurses' IPC practice 4 years or less OR = 0.764 (95% CI 0.170 – 3.445). Similarly, the age of the participants has an effect on their IPC practices, 29 years and younger OR = 0.703 (95% CI 0.155 – 3.181) and 30 39 years OR 0.881 (95% CI 0.227 – 3.419). The nurses' level of knowledge for IPC was found to have an effect on their IPC practices OR = 0.086 (95% CI 0.013 – 0.571) there was statistical significance in this relationship (p=0.011). However, though the attitude of the nurses had an effect on their IPC practice, there was not statistical significance (p = 0.194).

Table 4.11: Binary logistic regression for IPC practice

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B) Lower	Upper
Step 1[a]	Highest qualifications			4.438	2	.109			
	Nursing certificate	-1.138	.749	2.306	1	.129	.321	.074	1.392
	Diploma in Nursing	.389	.731	.283	1	.594	1.475	.352	6.178
	Years in practice			6.644	3	.084			
	4 years and less	-.269	.768	.122	1	.726	.764	.170	3.445
	5 – 9 years	-.919	.701	1.720	1	.190	.399	.101	1.575
	10 – 19 years	-2.461	.976	6.351	1	.012	.085	.013	.579
	Those who attended training on hospital infection	-2.551	1.235	4.269	1	.039	.078	.007	.877
	Adequate knowledge	-2.453	.966	6.448	1	.011	.086	.013	.571
	Nurses' Attitude	-1.137	.877	1.684	1	.194	.321	.058	1.787
	Age			.226	2	.893			
	29 years old and younger	-.353	.770	.210	1	.647	.703	.155	3.181
	30 – 39 years	-.127	.692	.034	1	.854	.881	.227	3.419
	Constant	2.350	1.222	3.698	1	.054	10.490		

a. Variable(s) entered on step 1: Highest qualifications, Years in practice, Attended training on hospital infection, Nurses' Knowledge, Nurses' Attitude, Age.

4.9.3.1 Nurses' practice related to their nursing category

Figure 4.14 shows that less than half n=36 (40%) of the participants were found to have good IPC practices in terms of compliance with the IPC programme, whereas the majority n=54 (60%) were non-compliant.

Unit managers participated in this study n = 5 (5.5% of the n=90 participants) and less than two-thirds of them n=3 (60%) were found to be compliant with the IPC programme; the rest n = 2 (40%) were non-compliant. All (100%) senior registered nurses n=4 (4.4% of n=90) were found to be non-compliant with the IPC programme. Registered nurses constituted almost half of the participants n=44 (48.9%) and close to half of them were found to be compliant n=21(47.7%); the rest n=23 (52.3%) were non-compliant.
The category of enrolled nurse and enrolled nurse auxiliary represented the second highest number of participants n=37 (41.1%), and close to a third n=12 (32.4%) were found to be compliant; the rest n=25 (67.6%) were non-compliant. There is no statistical association as p=0.140 (df=3). The standardised statistic is positive, above average (z=1.060).

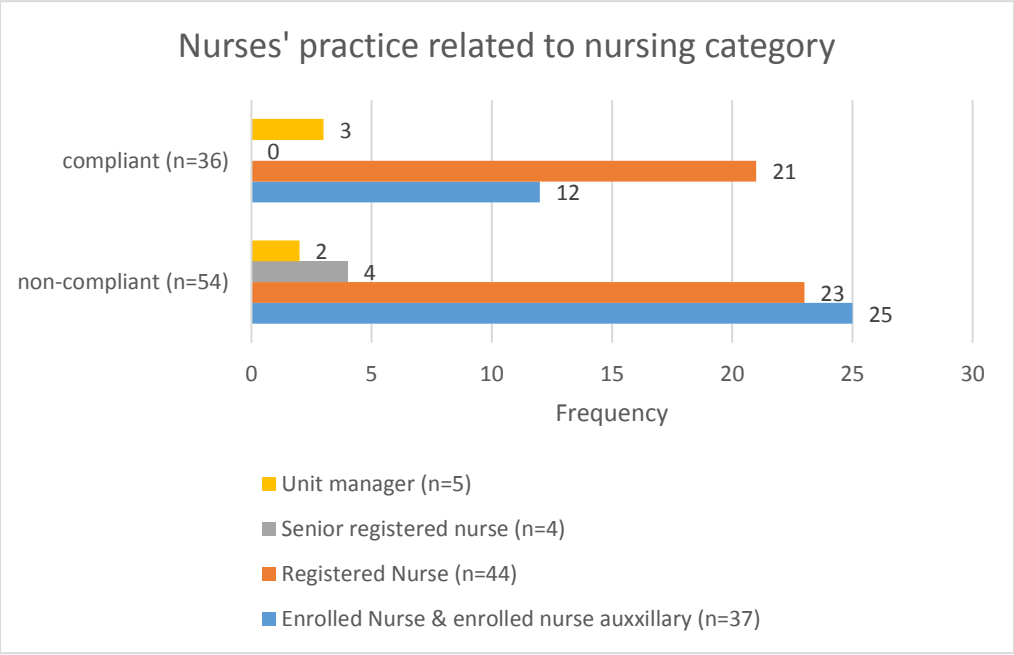


Figure 4.14: Nurses' practice related to their nursing category.

4.9.3.2 Nurses' practice in infection prevention and control related to their highest qualifications

The results in Figure 4.15 show that almost a quarter of the participants n=21 (23.3%) had a bachelor's degree in nursing, and almost half of them n=10 (47.6%) were found to comply with the IPC programme, and the rest n=11 (52.4%) were non-compliant. Most of the participants n=33 (36.6%) held a nursing diploma qualification. Less than half of them n=15 (45.5%) were found to be compliant with the IPC programme whereas the majority n=18(54.5%) were non-compliant. Nurses whose highest qualification was a nursing certificate or grade 12 accounted for the majority of participants n= 36 (40%), and less than a third of them n=11 (30.6%) were compliant; the rest n= 25 (69.4%) were not compliant. There is no statistical association between nurses' practice and qualifications, p= 0.324 (df=2). The standardised statistic is positive, above average (z=1.375).

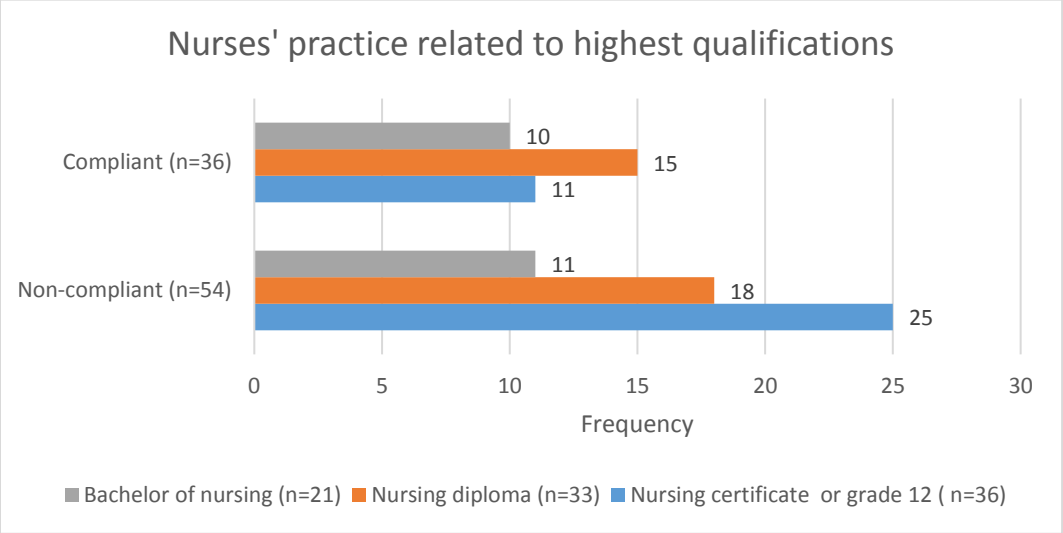


Figure 4.15: Nurses' practice related to their highest qualifications.

4.9.3.3 Nurses' practice of infection prevention and control related to years in

nursing practice

Figure 4.16 below shows that the nurses who had been in practice for four years and less represented less than a third of the participants n=26 (28.85%): just over a third of them n=10 (38.5%) complied with the IPC programme, and the rest n=16 (61.5%) were non-compliant. Those who had been in nursing practice between 5 to 9 years also represented just less than a third of the participants n=29 (32.2%): just over two-fifths of them n=12 (41.4%) were compliant, and the rest n =17 (58.5%) were non-compliant. Out of those with nursing experience of 10 to 19 years n=15 (16.7%) very few n=3 (20%) complied with the IPC programme; the rest n=12 (80%) did not comply. On the other hand those who had the most experience of 20 years and more n=20 (22.2%) were more compliant with the IPC programme n=11 (55%); the rest n=9 (45%) were found to be non-compliant.

The results show that there is no statistical significance, p=0.219 (df=3). The standardised statistic is positive, above average (z=0.932).

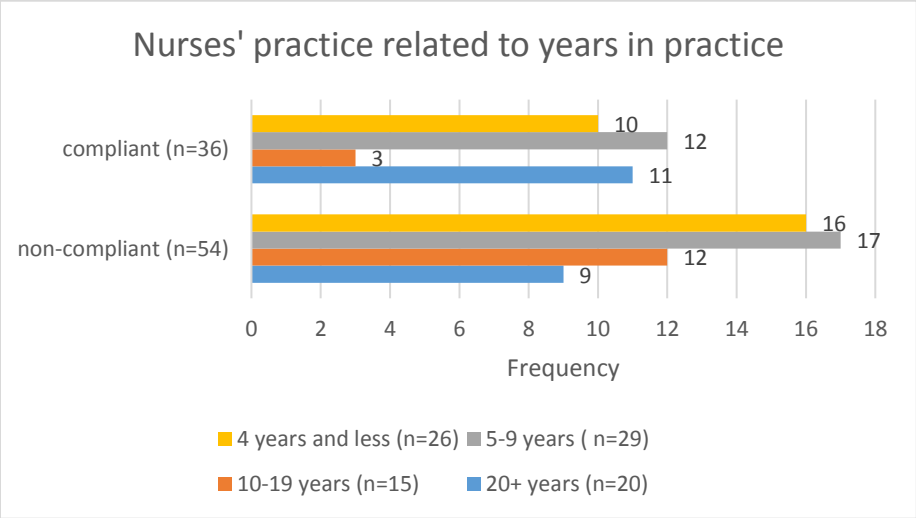


Figure 4.16: Nurses' practice of infection prevention and control related to years in nursing practice.

4.9.3.4 Nurses' practice related to attending training on hospital infection

prevention and control

Figure 4.17 indicates that the majority of participants n=80 (88.9%) had attended training on hospital infection prevention and control, and the rest n=10 (11.1%) had not or did not know if they had done so From those 80 who attended training just of two-fifths of them n=35 (43.8%) did practice good IPC practices that complied with the IPC programme; the majority n=45 (56.2%) did not comply with the programme. Compliance was not evident in the majority who did not attend or did not know whether they attended training on IPC: only one n=1 (10%) was compliant and the rest n=9 (90%) were found to be non-compliant. The results show that there is statistical significant, p=0.040 (df=1). The standardised statistic is positive, above average (z=2.043).

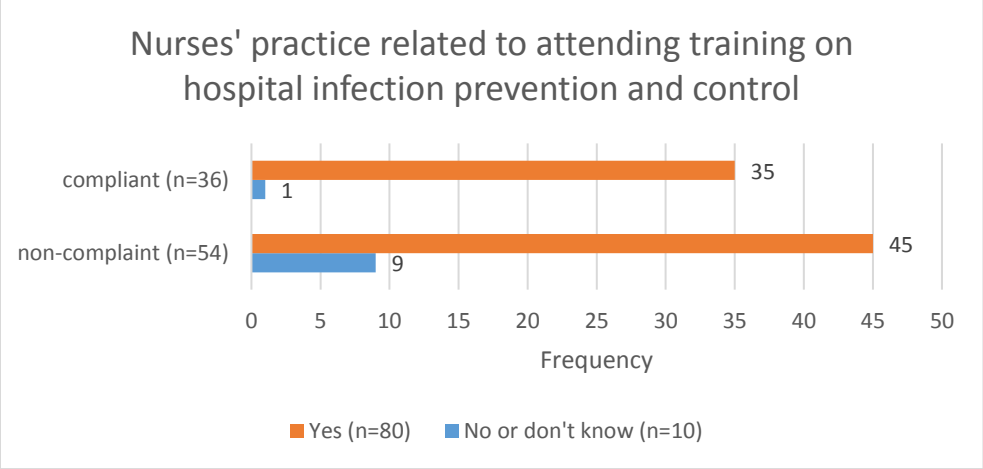


Figure 4.17: Nurses' practice related to attending training on hospital infection prevention and control.

4.9.3.5 Nurses' practices in infection prevention and control related to gender

Figure 4.18 shows gender participation: males n=5 (5.6%) and females n=85 (94.4%). Data show the following: male compliancy with the IPC programme n=1 (20%) and non-compliancy n=4 (80%); female compliancy n=35 (41.2%) and non-compliancy n=50 (58.8%). There is no statistical significance p=0.348 (df= 1). The standardised statistic is positive, above average (z=0.934).

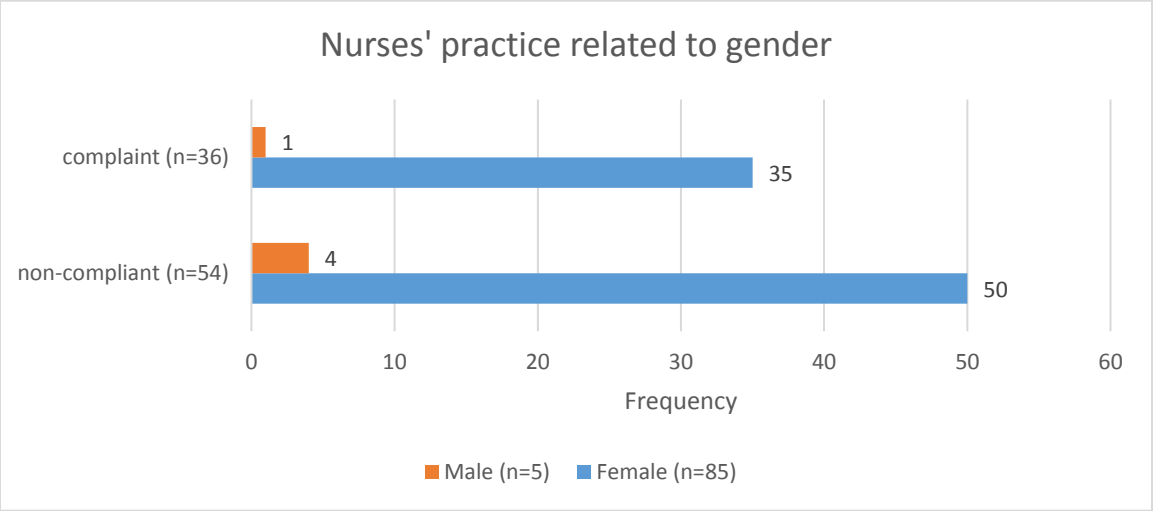


Figure 4:18: Nurses' practices related to gender.

4.9.3.6 Nurses' practice related to their knowledge of infection prevention and control

Figure 4.19 below indicates that one-fifth n=18 (20%) of the participants had inadequate knowledge of IPC. As a result, only a few n=2 (11.1%) of them were found to be compliant with the IPC practice; and majority n=16 (88.9%) were not compliant. On the other hand, the majority n=72 (80%) with adequate knowledge of IPC, led to almost half of them n=34 (47.2%) complying with the IPC practices; the rest n=38 (52.8%) were non-compliant. There is a statistical association between the participants' IPC practice and their knowledge of IPC, p=0.005 (df=1). The standardised statistic is positive, far above average (z=2.782)

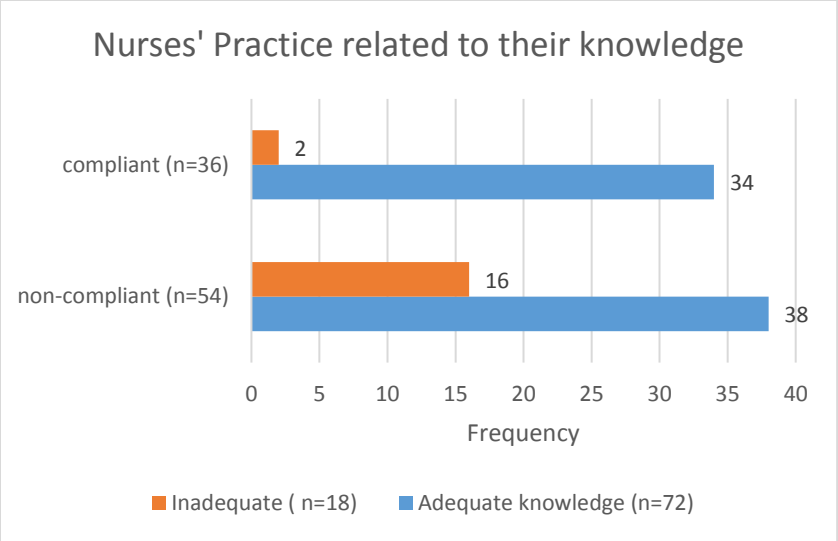


Figure 4.19: Nurses' practice related to their knowledge of infection prevention and control.

4.9.3.7 Nurses' practice related to their attitude towards infection prevention and control

The results in Figure 4.20 below indicate that the majority of participants n=76 (84.4%) had a positive attitude towards IPC; however, not all were compliant with the IPC practices: n=30 (39.5%) were compliant and rest n=46 (60.5%) were not compliant. On the other hand, from those with a negative attitude toward IPC n=14 (15.6%), just over two-fifths n=6 (42.9%) were compliant; the rest n=8 (57.1%) were found to be non-compliant.

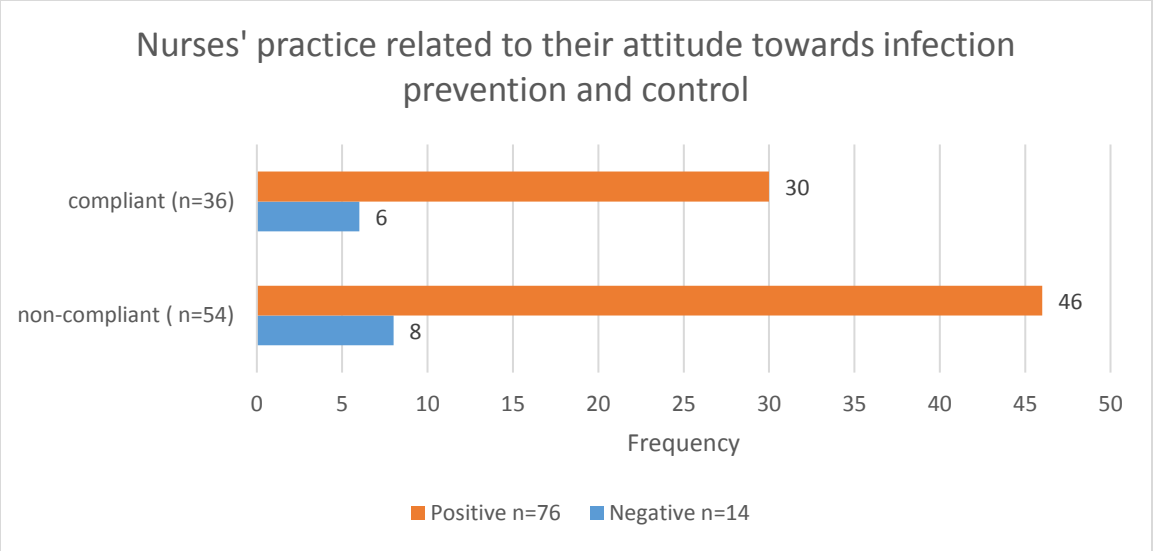


Figure 4.20: Nurses' practice related to their attitude towards infection prevention and control.

Figure 4.20 shows the relationship between the nurses' IPC practice at the private hospital and their attitude. Out of those with good practices of infection prevention and control n=36 (40%) a small number n=6 (16.7%) had a negative attitude towards IPC. Therefore, although nurses do implement IPC practices it is reasonable to assume that some resent what they do.

In terms of those nurses with poor practices n=54 (60%), the result shows that some n=8 (14.8%) had a negative attitude towards IPC.

There is no statistical association between participants' practice of IPC and their attitude, p=0.364 (df=2). The standardised statistic is positive, above average (z=1.401).

4.10 Summary

In this chapter, the collected data were analysed, summarised, interpreted and discussed. The binary logistic regression indicated a statistically significant difference in the participants' attitude towards IPC in relation to their age. Moreover, there was a significant difference between those who had adequate knowledge and those who did not, and their attitude towards IPC and their IPC practices. However, no statistical significance was observed for nursing categories, highest qualification, years in practice, attending IPC training, and gender, in relation to their attitude towards IPC and their IPC practice. Only

the nurses' attitude that related to their highest qualification indicated a negative (below the mean average) score from the standardised statistic calculated.

The research question was successfully explored and answered. The identified objectives were answered. In the next chapter, the results are discussed in relation to the four research objectives. Conclusions are drawn made and recommendations are made.

CHAPTER 5
DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In chapter 1 the foundation of the study was discussed. The rationale for this study was stated and the aims and objectives outlined. Chapter 2 dealt with an in-depth literature review with regards to nurses' knowledge, attitude and practices of infection prevention and control. In Chapter 3 research methodology was covered. Data analysis and interpretation were presented in Chapter 4.

In this chapter, the researcher provides an overall discussion of the study. Conclusions made from the interpretation of the data are presented. Recommendations are made. The limitations of the research process are discussed and final conclusions drawn.

5.2 Discussion of objectives

The aim of the study was to investigate the nurses' knowledge, attitude and practices of infection prevention and control at the private hospital in Namibia. There were four objectives and these are discussed in relation to the findings of the study.

5.2.1 Objective 1. To explore the nurses' knowledge of infection prevention and control at a private hospital in Namibia

This objective aimed to determine nurses' level of knowledge on infection prevention and control. From the data presented in Table 4.2 the majority n=72 (80%) of the participants had adequate knowledge; n=18 (20%) had inadequate knowledge of healthcare-associated infection. The findings in the current study are in keeping with those of several studies where participants were found to have adequate knowledge of infection prevention and control (Abdullah & Idriz 2017: 84; Garba *et al*., 2016:34; Hussen *et al*., 2017:6). In the current study, the following aspect stood out in the session on knowledge;

5.2.1.1 Hand Washing

It is recommended that in order to prevention the transmission of micro-organsims, healthcare workers should wash their hands when they are visbly dirty, after the risk of exposure to blood or bodily fluid or after a nurse has been in contact with a patient with c-diff diarrhoea (Dramowski, 2018: 94). This study found n=57 (63.3%) of the participants disagreed that hands should only be washed when visibly soiled (Table 4.2).

The washing of hands reduces the amount of miroorganisms colonisng the skin of the healthcare workers and does not sterilise the hands. For this reason addition barriers should be used to prevent the transmission of microorganisms (Wistrand, Soderquist, Falk-Brynhidsen & Nilsson 2018:5). However, the results indicate that n=25 (27.8%) of the participants agreed that healthcare workers can sterilise their hands by washing with soap and water (Table 4.2).

5.2.1.2 Glove use

The majority of nurses in this study n=39 (43.3%) agreed that gloves should always be worn when coming in contact with a patient (Table 4.2). The overuse of gloves has been associated with colonisation of surfaces with microorganisms. For this reason, excessive use of gloves is discouraged, as this provides a false sense of protection, and should only be used when indicated by a risk assessment (Mehtar, 2010:168).

5.2.1.3 Chlorhexidine showers

According to Darouiche (2016:5), in order to reduce the risk of surgical site infections (SSI), three preoperative chlorhexidine showers are recommended after which no creams or lotions may be applied. As shown in Table 4.2 a third n=30 (33.3%) of the participants disagreed that all surgical patients should have three preoperative chlorhexidine showers. Although the nurses' knowledge of infection prevention and control was adequate some areas of the specific knowledge are a concern as discussed above.

5.2.2 Objective 2. To describe the nurses' attitudes towards the IPC at a private hospital in Namibia.

Based on the data presented in Chapter four, the majority of the nurses n=76 (84.4%) had a positive attitude towards IPC; only n=14 (15.6%) were found to have a negative attitude (Table 4.4). These findings are in keeping with previous studies that indicated that the majority of participants had a moderate to good attitude towards IPC (Nofal, Subih & Al-Kalaldeh, 2017:1; Abdullah & Idriz, 2017:84; Hussen *et al*., 2017:4). Nurses who portray a negative attitude have an influence on the quality care and patient safety related to infection prevention and control.

5.2.2.1 The effect of nurses' age on attitude towards IPC

In this study the age of the nurses was found to be linked to their attitude towards IPC. Negative attitudes were among the younger nurses and a positive attitude in those between the age of 30 and 39 years. These findings are contrary to another study which found the older more experience nurses to have a more negative attitude towards IPC (Ward 2012: 302).

5.2.2.2 Increased workload

The majority of participants in this study n=67 (74.4%) agreed that following the IPC programme does result in additional work for healthcare workers as they are already busy with patient care. The majority n=70 (77.8%) agreed that doing the procedure according to the manual takes up too much time. These findings are similar to another study where compliance with IPC was viewed to increase the workload (Ward 2012:302).

5.2.2.3 Supervision and IPC compliance

Furthermore, the majority n=79 (87.9%) agreed that they only follow the IPC programme when being watched by their supervisor (Table 4.4). These findings are consistent with a study in which the participants viewed the IPC programme as an added burden to patient care, therefore adherence only happens when under the eye of more senior personnel (Ward, 2012:651). If nurses do not understand the value of the infection prevention and control activities and programmes, their behaviour will not be aligned with the infection prevention and control culture of a healthcare institution.

5.2.2.4 Patient with infectious disease

The majority of the participants n=76 (84.4%) agreed that the IPC programme should only be followed when nursing a patient with an infectious disease. A patient may however be infectious before symptoms emerge. Therefore, IPC precautions should be taken for all the patients whether suspected or confirmed to be infectious (CDC, 2018:n.p). Being consistent with IPC precautions would eliminate healthcare workers' understandable fear of occupational infection, but as shown in Table 4.4 almost a third n=27 (30%) of the participants disagreed with this statement.

It is of concern that a few nurses in the private hospital in this study still have a negative attitude related to infection prevention and control.

5.2.3 Objective 3. To determine the infection control practices of nurses at a private hospital in Namibia

The data presented in Chapter four show that not many n=36 (40%) of the nurses complied with the IPC practice; the majority n=54 (60%) were non-compliant as shown in Table 4.7.

5.2.3.1 Hand hygiene

In terms of hand hygiene, as shown in Table 4.6, almost a quarter n=21 (23.3%) of the participants indicated that they never/ rarely wash their hands after removing disposable gloves. According to Dramowski (2018:73), hands could become contaminated through the gloves, therefore hands washing after removal of gloves is vital.

5.2.3.2 Use of PPE (personal protective equipment)

As shown in Table 4.6 just over a third n=36 (40%) of the nurses indicated that they never/rarely wear a waterproof apron whenever there is a splash risk of blood or bodily

fluids. This is contrary to IPC guidelines. The following must be used: gowns/aprons to protect skin and /or clothing and goggles to protect the eyes; face mask and N95 respirator to protect the respiratory tract against airborne infectious agents. A face shield must be used to protect one's face, mouth, nose and eyes whenever there is a risk of blood or bodily fluid splashing (Mehtar, 2010:169).

In this study, two items focused on precautions taken by the nurses to protect themselves from infections. These precautions pertained to wearing of gloves and aprons when there is a risk of splatters from a patient. Just over a half (56.1%) of the participants indicated that they always take these precautions. Even though nurses may have the knowledge that they are at risk of acquiring HAIs if they do not apply what they know (see Table 4.8), they do not always take the necessary precautions to ensure prevention.

5.2.3.3 Wearing clean uniform daily

In terms of wearing a clean uniform every day the majority n=85 (94.4%) of the participants never or rarely wear a clean washed uniform every day as shown in Table 4.6. A poor technique of removing PPE may result in self-contamination of the users' skin, own clothes, uniforms, hair and hands of healthcare workers (Pang, 2014: 14). For this reason, it is recommended that healthcare workers must wear a clean washed uniform each day to prevent cross-infection.

5.2.3.4 Sharps safety

It is worth noting that all the participants n=90 (100%) indicated that they always put used needles and other sharps objects in the designated sharp containers, and most n=64 (71.1%) always recapped used needles as shown in Table 4.6. The CDC recommendations are that all sharp objects contaminated with patients' bodily fluid are infectious; needles should therefore not be recapped after use as this puts one at risk of needle stick injuries: healthcare workers may however use the one-handed scoop method to recap the needle (CDC, 2018:n.p).

5.2.4 Objective 4. To describe the relationships between the level of knowledge and attitude and the infection prevention and control practices at a private

hospital in Namibia

5.2.4.1 Relationship between knowledge and attitude toward IPC

There is a significant relationship between knowledge and attitude towards IPC (p = 0.002). The results presented in Table 4.8 indicate that the majority of participants n=72 (80%) who had adequate knowledge of IPC; the majority n=65 (90.3%) had a positive attitude towards IPC, and a very small minority n=7 (9.7%) had a negative attitude.

5.2.4.2 Relationship between knowledge and practices of IPC

There is significant relationship between knowledge and practices of IPC (p=0.005). Almost half of those with adequate knowledge n=34 (47.2%) were found to be compliant with the IPC practice; the majority n=38 (52.8%) did not comply with the IPC practice. A similar trend was noted in those with inadequate knowledge: n=2 (11.1%) were compliant and n=16 (88.9%) were non-compliant (Figure 4.19). These results are similar to those of a study in the literature in which 99.3% of nurses had adequate knowledge, but only 60.5% complied with the IPC practice (Hussen *et al*., 2016:6). On the other hand a 2015 study showed that 40.7% of the nurses had adequate knowledge, resulting in average compliance of 48.7% (Freahiywot *et al.,* 2015:3).

5.2.4.3 Relationship between attitude and practices of IPC

There is no relationship between attitude and practices of IPC (p=0.364). Figure 4.20 shown from the participants with a positive attitude towards IPC n=76 (84.4%) there were n=30 (39.5%) who were compliant with the IPC practice; the majority n=46 (60.5%) were not compliant. On the other hand, out of those with a with a negative attitude towards IPC n=14 (15.6%) there were n=6 (42.9%) who were compliant; the balance n=8 (57.1%) were non-compliant as shown in Figure 4.20. The findings in this study align with a study where 93.4% of participants had a positive attitude toward IPC guidelines, however, only some (60.5%) of them complied with these guidelines (Hussen *et al*., 2016:4). On the other hand, Sarani *et al*.(2016: 195) reported that in their study, only a moderate number of nurses (37%) had a positive attitude towards IPC, which resulted an average (42%) IPC compliance. These findings are contrary to another study which found positive attitude and good compliance, despite them having poor knowledge of IPC (Nofal, 207:187).

It is not unreasonable to argue that the poor compliance with the IPC practice had an influence on the poor adherence of the IPC programme subsequently high HAIs rates reported at the private hospital in this study. In terms of the literature, Darawad and Al-Hussami (2013:582) stated, that in order to reduce HAI rates, a minimum 80% compliance with an IPC programme is required which are influence by the nurses knowledge, attitude and practices in infection prevention and control. Put differently, the lack of compliance with an IPC programme is linked to a high HAIs prevalence (Jeong *et al*., 2013:712).

5.3 Discussion related to the conceptual framework

The results related to the conceptual framework on which the study was based are discussed below.

5.3.1 Nurses' knowledge on infection prevention and control

The nurses' level of knowledge (80%) of IPC in the private hospital did have an influence on their positive attitude (90.3%) towards IPC. The significance of this is that nurses who are competent then become confident to perform tasks with ease, (perceived control) as a result their attitude becomes positive (McGraw, 2012:6).

5.3.2 Nurses' attitude towards infection prevention and control

The conceptual framework in Figure 1.1 illustrates that according to the theory of planned behaviour, a person's attitude toward behaviour is influenced by consequences that may result from the behaviour, perceived control, and subjective norms (McGaw *et al*., 2012:6). It is argued therefore that although a positive attitude of the participants in this study (84.4%), 60% are still not compliant to the practices of infection prevention and control.

5.3.3 Nurses' practices of infection prevention and control

In terms of the findings of this study the participants' compliance of practices of IPC was influenced by their level of knowledge of and attitude towards IPC. Nurses do comply with

the IPC practices when they perceive the ease with which the task can be performed (McGraw, 2012:7).

5.4 Limitations of the study

The study only looked at the IPC knowledge, attitude and practices of nurses as they spend the most time at the patient's bedside. Other members of the healthcare multidisciplinary team were excluded from this study; they are also equally responsible for the spread of HAIs.

This study focused on the nurses of only one healthcare facility, and this may limit generalisation of the research finding to other hospitals. The total population of nurses in the research setting was small, thus the findings cannot be generalised to the general population of nurses in Namibia.

5.5 Conclusions

The discussions in this chapter focused on determining whether the objectives of study were achieved. The results confirmed that although most of the nurses' knowledge of IPC was adequate, and their attitude towards IPC was positive. Poor IPC practices were however still evident in the private hospital. Nurses do understand that they are at risk of acquiring HAIs, but they do not take the necessary precautionary measures to protect themselves from infections.

This study's findings are in keeping with that reported in the literature, namely, even if healthcare workers have adequate knowledge and a positive attitude towards IPC, this is not enough to ensure compliance with the IPC practices; (Jansson *et al.*, 2013:216). The overall compliance of 40 %, falls below the 80% recommended ensuring HAI prevention and control.

The research question in 1.5 is as follows. What is the nurses' knowledge, attitude and practices of infection prevention and control at the private hospital? As discussed above this study did successfully answer this question.

5.6 Recommendations

The following recommendations generated from the results focused on three findings.

- The 20% of the participants who lacked knowledge of IPC.
- Those (15.6%) who had a negative attitude towards infection prevention and control.
- Those who showed non-compliance of the practices of IPC (60%).

5.6.1 Education and training

According to Baral (2015:867) training on IPC should not only focus on information sharing as it should also empower participants to believe in their ability to bring about the required change through their behavior. The following areas should be the focus of IPC in-service training;

- Handwashing; the moments of hand hygiene should be re-emphasized. In addition, the nurses should be informed of that the reason for hand hygiene is not to sterilize the hands but to remove microorganisms colonizing the skin
- The use of PPE; Training on the importance of using gloves and other PPE. In order to avoid unnecessary excessive use that may lead to surface contamination or under use that may result in self contamination and occupational infections.
- The importance of wearing a clean uniform daily should be reiterated, as the uniform may become contaminated through inadequate or improper use of PPE
- Chlorhexidine showers; all patients should take 3 chlorhexidine showers pre-operatively, in order to reduce the amount of micro-organisms colonizing the skin which may lead to SSI during the operation
- Training of injection safety and proper handling and disposal of sharps.

5.6.2 Nurses' attitude towards IPC

The following variables were found to have an effect on the nurses' attitude towards IPC;

- The age of the nurses; the younger nurses were found to have a negative attitude towards IPC. The reasons behind this should be explored further.
- Increased workload; the IPC program should form an integral part of patient care, and viewed as an additional task.
- The value of integrity should be instilled in nurses, in order for them to consistently comply with the guidelines, and not only when the supervisor is around or the patient is known to have an infectious disease.

5.6.3 Strict measures are enforced when non-compliance occurs

It is considered negligence when a nurse fails to take necessary measures to prevent disease and suffering of patients. As a result, their actions may lead to avoidable HAIs that may have a significant impact on the morbidity, mortality and quality of life of patients. In addition, such negligence may have financial implications for a healthcare facility (White, Jimmieson, Obst, Graves et. al., 2019:10).

The hospital in this study is committed to providing training to ensure adequate IPC knowledge as shown in Table 4.4. In view of this those nurses who are found to be non-compliant should be told to strictly follow the hospital's policy and, if necessary, disciplinary measures enforced, on grounds of poor work performance. In terms of the planned behaviour theory, and its factors that influence behaviour (McGaw *et al*., 2012:6), the followed is underscored based on the results of this study.

- There are consequences that result from behaviour of nurses. When strict discipline is enforced, this should influence their behaviour as the consequences of non-compliance will have a negative impact on them.

- Perceived control is the degree of hardship with which a task can be executed. In order to make the workload lighter, the management of the private hospital should ensure adequate staffing to prevent burnout.

- Subjective norms mean what is socially acceptable when disciplinary measures are strictly enforced. It is important that the nurses are made to understand that non-compliance with the IPC programme is not socially accepted nor will it be tolerated.

For this reason, disciplinary measures put in place should encourage behavioural change. However, to ensure a conducive working environment, disciplinary measures alone, as a form of behavioural change, may not be effective. One must guard against nurses working in fear of the consequences. Other interventions should be used to encourage behavioural change (White, Jimmieson, Obst, Graves et. al., 2019:8).

5.6.4 Focus interventions for behavioural change

The findings from this study revealed that the attitude of the nurses was a major factor influencing non-compliance with the IPC practices. In addition to disciplinary measures, the private hospital in this study should focus on interventions that encourage behavioural change in the nurses. Interventions that focus on team-building would encourage a sense of ownership and pride in their work.

Personnel who have a passion for IPC could be identified to be IPC champion or representatives for their respective departments. Together with the hospital IPC specialist, the IPC champions could run IPC interventions in their respective departments (Stor, et. al., 2017: 3).

5.6.5 Proactive IPC committee

The private hospital has an established IPC committee, comprising representatives from the different departments in the hospital. However, these representatives should become more proactive in IPC in their departments. They should have a passion for infection prevention and control, and should be a role model and lead by example. In addition, the role of an IPC representative is monitoring and auditing of compliance with the IPC programme. Monitoring should be conducted on a continuous basis to ensure that the different elements of the IPC programme are adhered to. In addition, nurses should be monitored when conducting aseptic procedures (Mugomeri 2018:13)

5.6.6 Create a culture of IPC practice

Culture in an organisation is defined as the pattern of basic assumption that a given group has invented, discovered, or developed in learning to cope with its problems of external adaptation, internal integration, which has worked well enough to be considered valid,

and is passed on to new members as the correct way to perceive, think and feel toward the problems (Baral, 2015:866). An organisation's culture may be linked to the theory of planned behaviour, which indicates that the attitude of a person toward behaviour is influenced by what is accepted to be normal (perceived norms) (McGraw, 2012:6). In order to ensure a reduction in HAIs, the hospital in this study should adopt a culture of compliance to the IPC programme. The hospital management team must provide support to personnel at the operational level, and give positive feedback when targets are met.

5.7 Future research

Due to the nature of the questionnaire, the participants could only answer closed-ended questions. Consequently, the reason for their answers could not be explored in-depth. For this reason, the researcher recommends a qualitative study should be done for deeper exploration of the experiences of the nurses with regards to compliance with the IPC programme.

The following areas for future research are proposed.

- Factors influencing nurses' attitude towards infection prevention and control.
- A study of healthcare workers' knowledge, attitude and practices on infection control in Namibia (state-owned and private facilities).
- Factors that is associated with non-compliance with the IPC programme.

5.8 Dissemination

The findings of this study are to be published in the form of a thesis through the University of Stellenbosch. Further papers will be submitted to a reputable journal for publication. The researcher will present the research findings to the management of the private hospital where the recommendations will be outlined.

5.9 Conclusion

Based on research findings, the researcher can clearly state that the nurses' compliance with IPC was poor as shown in Table 4. 9. Overall the nurses have a positive attitude

toward IPC. The conceptual framework indicates what factors may influence nurses' attitudes and how such an attitude impacts on the overall compliance with the IPC practice. The researcher hopes that the recommendations made will motivate behavioural change and improve compliance with the IPC programmes, which will consequently reduce the rate of HAIs in the private hospital.

References

Allegranzi, B., Bagheri, NS., Combescure, C.& Graafmans, W. 2011. *Lancet* 377(1): 228 – 241. Burden of endemic Healthcare Associated Infections in developing countries: systematic review and meta-analysis. [Online]. Available:https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/21146207 [2019, October 15].

AlKubati, A.S., Ahmed, T.N., Mohammed, O.N.E., Fayed, A.M. & Asfour, H.I. 2015. Health care workers' knowledge and practices regarding the prevention of central catheter-related infection. *American journal of infection control,* 43 (1): 26 -30.

Alrubaiee, G., Baharom, A., Shahar, HK., Daud, SM. & Basaleem, HO. 2017. Knowledge and practices of nurses regarding nosocomial infection measures in private hospitals in Sana'a City, Yemen. [Online]. Available: https://safetyinhealth.biomedcentral.com/track/pdf/10.1186/s40886-017-0067-4 [2019, October 2].

Amoran, O. & Onwube, O. 2013. Infection control and practices of standard precaution among healthcare workers in northern Nigeria. *Journal of global infectious diseases,* 5(4): 156 – 163.

Bagheri, NS., Allegranzi, B., Syed, SB., Ellis, B. & Pittet, D. 2011. *Bulletin of World Health Organisation* 89(10): 757 – 765. Healthcare associated infections in Africa: A systematic review. [Online]. Available:https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC3209981/pdf/BLT.11.088179.pdf [2019, November 8].

Bano, R., AlShammari, E., Fatima, S.B. & AlShammari, N.A. 2013. A comparative study of knowledge, attitude, practices of nutrition and non-nutrition students towards a balance diet in HCAII University. *Journal of Nursing and Health Science,* 2 (3): 29 – 36.

Baral, R. 2015. Journal of pathology of Nepal 5(1): 865 – 868. Organisational culture and its implications on infection prevention and control. [Online]. Available: https://www.nepjol.info/index.php/JPN/article/view/15644 [2019, November 10].

Barbadoro, P., Labricciosa, FM., Recanatini, C., Gori, G., Tirabassi, F., Martini, E., Gioia, MG., D'Errico, MM. & Prospero, E. 2015. *American journal of infection control* 43 (7): 707 – 710. Catheter associates urinary tract infection: Role of the setting of catheter insertion. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/?term=Barbadoro%2C+Labricciosa%2C+Recanatini%2C+Gori%2C [2019, November 2].

Bartlett, J. 2014. The Hosmer-Lemeshow goodness of fit test for logistic regression. [Online]. Available: https://thestatsgeek.com/2014/02/16/the-hosmer-lemeshow-goodness-of-fit-test-for-logistic-regression/ [2019, November 15].

Benac, E. 2017. Degree of freedom in Chi-square test. [Online]. Available: https://sciencing.com/info-8027315-degrees-freedom-chisquare-test.html [2019, November 8].

Bergamini, M., Cucchi, A., Stefanati, A., Cavallaro, A., & Gabutti, G. 2009. Knowledge of preventive measures against the spread of healthcare-associated infections amongst nursing students. An epidemiological prevalence study from Ferrara, Italy. *Journal of med hyg,* 50(1): 96 – 101.

Best care Always (BCA) 2018. Interventions to reduce Healthcare associated infections. [Online]. Available: http://bestcare.org.za/home [2019, November 4].

Burns, N. & Grove, S.K. 2011. Understanding nursing research: Building an evidence-based practice. 5th Edition. Maryland: Elsevier Saunders.

Chakra, CN., Pepin, J., Sirard, S. & Valiquette, L. 2014. *PLoS one* 9(6):1 -14. Risk factors for reccurence, complications and mortality in clostridium difficile infection: A systematic review. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/24897375 [2019, September 16].

Charles, MP., Kali, A., Easow, JM., Joseph, NM., Ravishankar, M., Srinivavasan, S., Kumar, S. & Umadevi, S. 2014. *The Australian medical journal* 7 (8): 334 – 344. Ventilator associated pneumonia. [Online]. Available; https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/25279009 [2019, September 15].

Chopra, T., Neelakanta, A., Domecki, C., Awali, RA., Sharma, S., Kaye, KS., & Patel, P. 2015. *American journal of infection control* 43(4): 314 – 317. Burden of clostridium difficile infection on hospital re-admission reduction program. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/?term=chopra%2C+neelakanta [2019, November 8].

Darawad, M. & Al-Hussami, M. 2013. Jordanian nursing students' knowledge of, attitude towards and compliance with infection precautions. *Nurse education today,* 33 (6): 580 – 583.

Darouiche, R. 2016. *Hospital infection control* 9(3): 12-15. Surgical site infections. [Online]. Available: https://www.clinicaladvisor.com/home/decision-support-in-medicine/hospital-infection-control/surgical-site-infections/ [2018, August 2].

Dramowski, A. 2018. Infection prevention and control: A guide for healthcare workers in low resource settings. 1st Edition. Cape Town. Bettercare.

Dempsey, C., Reilly, B & Buhlman, N. 2014. *Journal of Nursing Administration.* 44(3): 142 – 151. Improving the patient experience: Real world strategies for engaging nurses [Online].Available:https://journals.lww.com/jonajournal/Abstract/2014/03000/Improving_the_Patient_Experience__Real_World.7.aspx [2019, November 08].

Frost, J. 2019. Statistics by Jim. [Online]. Available: https://statisticsbyjim.com/glossary/standardization/ [2019, November 10].

Garland, K.V. 2013. A survey of United States dental hygienists' knowledge, attitude, and practices with infection control guidelines. *The journal of dental hygiene,* 87 (3):140 – 151.

Geldenhuys, C., Dramowski, A., Jenkins, A. & Bekker, A. 2017. *South African medical journal* 107(9): 758 – 762. Central line associated blood stream infections in a resource limited South African neonatal intensive care unit. [Online]. Available: https://www.ncbi.nlm.nih.gov/pubmed/?term=Geldenhuys%2C+Dramowski%2C+Jenkins+and+Bekker [2019, November 7].

Grove, S. K., Burns, N. & Gray, J. R. 2013. The Practice of Nursing Research: Appraisal, Synthes

is and Generation of Evidence. 7th Edition. Missouri: Elsevier Saunders

Gruda, A. & Sopjani, I. 2017. *Mater sociomed* 29 (2): 84 – 87. The knowledge, attitude and practice of nurses towards management of hospital acquired infections in the university clinical center of Kosovo. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5544441/pdf/MSM-29-84.pdf [2019, October 8].

Haddadin, Y. & Regunath, H. 2019. Central line associated blood stream infection (CLABSI). Treasure Island. Stat Pearls publishing LLC [Online]. Available: https://www.ncbi.nlm.nih.gov/books/NBK430891/ [2019, November 7].

Hamadah, R., Kharraz, R., Alshangity, A., Alfawaz, D., Eshaq, M.A., & Abu-Zaid, A. 2015. Hand hygiene: knowledge and attitude of fourth-year clerkship medical students at Alfaisal University, College of Medicine, Riyadh, Saudi Arabia. *Cureus,* 7(8): 310 – 319.

Hamishehkar, H., Vahidinezhad, M., Mashayekhi, S.O., Asgharian, P., Hassankhani, H., & Mahmoodpoor, A. 2014. Education alone is not enough in Ventilator Associated Pneumonia care bundle compliance. *Journal of Respiratory Pharm Practice,* 3(2): 51 -55.

Hand, L. 2014. Healthcare-Associated infection still a major issue, CDC says. *N Eng Journal of Medicine,* 370(1):1198 – 1208.

Hayes, A. 2019.Corporate finance and accounting. [Online]. Available: https://www.investopedia.com/terms/z/zscore.asp [2019, November 10].

He (2017) see p.38

Hussen, SH., Estifanos, WM., Melese, ES. & Moga, FE. 2017. *Journal of Nursing and care* 6 (4): 2 – 7. Knowledge, attitude and practice of infection prevention measures amongst healthcare workers in Wollaitta Sodo Otona teaching and referral hospital. [Online]. Available: https://www.researchgate.net/profile/Sultan_Hebo/publication/319454393_Knowledge_Attitude_and_Practice_of_Infection_Prevention_Measures_among_Health_Care_Workers_in_Wolaitta_Sodo_Otona_Teaching_and_Referral_Hospital/links/5a392609a6fdcc565c6ed49f/Knowledge-Attitude-and-Practice-of-Infection-Prevention-Measures-among-Health-Care-Workers-in-Wolaitta-Sodo-Otona-Teaching-and-Referral-Hospital.pdf [2019, October 8].

Ider, B., Adams, J., Morton, A., Whitby, M. & Clements, A. 2012.Perceptions of health care professionals regarding the main challenges and bariers to effective hospital infection control in Mongolia: A qualitative study. *BMC infectious diseases,* 12 (1):170 - 182.

Iliyasu, G., Dayyad, FM., Habib, ZG., Tiamiyu, AB., Abubakar, S., Mijinyama, MS. & Habib, AG. 2016. *Annals of African medicine* 15 (1): 34 – 40. Knowledge and practices of infection control amongst healthcare workers in a tertiary referral centre in North-western Nigeria. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC5452692/ [2019, October 18].

Jha, A.K., Larizgoitia, I., Audera-Lopez, C., Prasopa-Plaizier, N., Waters, H., & Bates, D. 2013. The global burden of unsafe medical care: analytic modelling of observational studies. *BMJ Quality Safety,* 22 (10):809-815.

Jansson, M., Ala-Kokko, T., Ylipalosaari, P., Syrjala, H. & Kyngas, H. 2013. Critical care nurses' knowledge of, adherence to and barriers toward evidence-based guidelines for Ventilator Associated Pneumonia. *Journal of Intensive and Critical care nursing.* 29(4):216 – 227.6.

Jeong, I.S., Park, S.M., Lee, J.L., Song, J. Y. & Lee, S.J. 2013. Effect of central line bundle on Central line associated bloodstream infections in the Intensive Care Unit. *Americal journal of Infection control,* 41 (8): 710-716.

Jooste, K. 2010. The principles and practice of nursing and health care: *Ethos and professional practice, management, staff development, and research*. Pretoria. Van Schaik publisher.

Kambau, C., Lee, KC., Hughes, GD. & Firstenberg, MS. 2015. *International journal of critical illness and injury science* 5(3): 170 – 178. Central line complications. [Online]. Available: https://www.ncbi.nlm.nih.gov/pubmed/26557487 [2019, November 7].

Kaur, J., Stone, P.W., Travers, JL., Cohen, CC. & Herzig, CTA. 2017. *American journal of infection control* 45 (9):1035 – 1040. Influence of staff infection control training on infection related quality measures in United States nursing homes. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/?term=influence+of+staff+infection+control+training+on+infection+related+quality+measures [2019, October 28].

Kilpatrick, C., Randle, J. & Prieto, J. 2014. Biofilm in infection prevention and control: A healthcare handbook. 1st Edition. (eds). *Hand Hygiene.* Amsterdam. Elsevier (American Press).

Lessa, FC., MU, Y., Bamberg, WM., Beldavs, ZG., Dumyati, GK., Dunn, JR., Farley, MM., Holzbauer SM., Meek, MI., Phipps, EC., Wilson, LE., Winston, LG., Cohen, JA., Limbaqo, BM., Fridkin, SK., Gerding, DN. & McDonald, LC. 2015. *The New England journal of medicine* 372(9):825 – 834. Burden of clostridium difficile infections in the United States. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/25714160 [2019, November 7].

Liu, J. T., Song, H.J., Wang, Y., Kang, Y., Jiang, L., Lin, S.H., Du, B., & Ma, P. A. 2013. Factors associated with low adherence to head-of-bed elevation during mechanical ventilation in Chinese intensive care units. *Chinese Medicine Journal,* 126(5): 834 – 838.

LoBiondo-Wood, G. & Haber, J. 2010. Nursing Research: Methods and Critical Appraisal for Evidence-based Practice.7th Edition. Missouri: Mosby Elsevier.

Manti, S. & Licari, A. 2018. *Breathe (sheff)* 14(2): 145 – 152. How to obtain informed consent for research. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5980471/ [2018, May 20].

McGaw, C.D., Tennant, I., Harding, H.E., Cawich, S.O., Crandon, I.W. & Walters, C.A. 2012. *International Journal of infection Control, 8(3):1 – 9.* Healthcare workers' attitude to and compliance with infection control guidelines in the operating department at the University Hospital of the West Indies, Jamaica. https://www.researchgate.net/profile/Cawich_Shamir/publication/258212266_Healthcare_workers'_attitudes_to_and_compliance_with_infection_control_guidelines_in_the_operating_department_at_the_University_Hospital_in_Jamaica/links/00b4952747e94a9f67000000.pdf [2017, June 12].

Mehtar, S. 2010. Understading infection prevention and control. 1st Edition. Cape Town. Juta & Company Ltd.

Mugomeri, E. 2018. *American journal of infection control* 46(3): 13-17. The efficacy of infection prevention and control committee in Lesotho: A qualitative study. [Online]. Available: https://www.sciencedirect.com/science/article/abs/pii/S019665531731297X [2020, February 3].

Nicolle, L. 2014. *Antimicrobial resistance and infection control* 3 (23): 1-8. Catheter associated urinary tract infection. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4114799/ [2019, November 7].

Nofal, M., Subin, M. & Al-Kalaldeh, M. 2017. *Journal of infection prevention* 18 (4): 182 – 188. Factors influencing compliance to the infection control precautions among nurses and physicians in Jordan: A cross-sectional study. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC5496691/pdf/10.1177_1757177417693676.pdf [2019, October 28].

Ojulong, J., Mitonga, K.H. & Iipinge, S.N. 2013. Knowledge and attitude of infection prevention and control amongst health science students at the University of Namibia. *African Health Sciences,* 13(4): 1071 – 1078.

Olowo-Okere, A., Ibrahim, YKE., Olanyike, BO. & Ehinmindu, JO. 2019. *The Nigerian postgraduate medicinal journal* 26(3): 143 – 151. Epidemiology of surgical site infections

in Nigeria: A systematic review and meta-analysis. [Online]. Available:https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/31441451 [2019, October 18].

Osuala, EO. & Oluwatosin, A. 2017. *Tropical journal of medical research* 20 (1): 53 – 60. Infection control by nurses in selected hospitals in Anambra state, Nigeria. [Online]. Available:http://www.tjmrjournal.org/article.asp?issn=1119-0388;year=2017;volume=20;issue=1;spage=53;epage=60;aulast=Osuala[2019, October 2].

Paudyal, P., Simkhada, P. & Bruce, J. 2008. Infection control knowledge, attitude and practices amongst Nepalese healthcare workers. *Americal Journal of infection control,* 36(8): 595 – 597.

Private hospital in Namibia. Infection Prevention and Control Department. 2017/2018. White paper on annual IPC reports.

Republic of Namibia. 2004. Nursing Act 8 of 2004. Windhoek: Government Printers. [Online]. A Available:http://www.lac.org.na/laws/annoNAM/HEALTH%20PROFESSIONS%20(2004)%20-%20Nursing%20Act%208%20of%202004%20(annotated).pdf [2019, September 20].

Roley, L.M.A. & Truscott. W. 2013. The costly burden of healthcare-associated infections [Online].Available: http://pt.halyardhealth.com/media/ [2016,April 01].

Rothe, C., Schlaich, C., & Thompson, S. 2013. Healthcare- associated infections in Sub-Saharan Africa. *Journal of Hospital Infection,* 85(2013):257 – 267.

Sadasivan, P., George, L. & Krishnarkumar, K. 2018. *World journal of pharmaceutical research* 7(11): 439 – 449. Ventilator associated pneumonia – Diagnosis and prevention strategies in critically ill patients: A review. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/?term=Sadasivan%2C+George%2C+Krishnarkumar+2018 [2019, November 2].

Salem, OA. 2019. *Annals medical health science research* 9 (1): 422 – 425. Knowledge and practices of nurses in infection prevention and control within a tertiary care hospital. [Online]. Available: https://www.amhsr.org/articles/knowledge-and-practices-of-nurses-in-infection-prevention-and-control-within-a-tertiary-care-hospital-5078.html [2019, October 18].

Sarani, H., Balouchi, A., Masinaeinezhad, N. & Ebrahimmitabs, E. 2016. *Global journal of health science* 8 (3): 193 – 198. Knowledge, attitude and practice of nurses about standard precautions for hospital acquired infections in teaching hospitals affiliated with Zabol University of medical sciences (2014). [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4804055/ [2019, October 28].

Sax, H., Allegranzi, B., Uckay, I., Larson, E., Boyce, J. & Pittet, D. 2007. *The journal of hospital infection* 67 (1): 9 -21. “My five moments for hand hygiene”: a user-centered design approach to understand, train, monitor and report hand hygiene. [Online]. Available:https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/17719685 [2019, November 8].

Schiessler, M., Darwin, L., Phipps, A., Hegemann, L., Heybrock, B. & MacFaydyen, A. 2019. *Pediatric quality safety* 4(4): e183. Don’t have doubt, get the catheter out: A nurse driven CAUTI prevention protocol. [Online]. Available: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6708639/ [2019, August 6].

Statistical How to. 2016. [Online]. Available: https://www.statisticshowto.datasciencecentral.com/hosmer-lemeshow-test/ [2019, November 9].

Storr, J., Twyman, A., Zingg, W., Damani, N., Kilpatrick, C., Reilley, J., Price, L., Egger, M., Grayson, L., Kelley, E., Allegranzi, B. & the WHO guideline development group. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC5223492/pdf/13756_2016_Article_149.pdf [2019, November 2].

Stubblefield, H. & Krucik, G. 2014.Health line. *Hospital Acquired (Nosocomial)* [Online]. Available: http://www.healthline.com./health/hospital-acquired-nosocomial-infections [2016, April 01].

Sutton, E., Brewster, L. & Torrant, C. 2019. *Healthcare expectations* 22 (4):650 – 656. Making infection prevention and control everyone’s business? Hospital staff views on patient involvement. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC6737752/ [2019, October 28].

Takesue, Y., Kushachi, S., Mikamo, H., Sato, J., Watanabe, A., Kiyota, H., Iwata, S., Kaku, M., Hanaki, H., Sumiyama, Y., Kitagawa, Y. et. al., 2018. *Journal of infection and chemotherapy* 24(5): 330- 340.Antimicrobial susceptibility of common pathogens isolated from post- operative intra-abdominal infections. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/29555391 [2019, October 20].

Teshager, FA., Egenda, EH. & Worku WZ. 2015. *Surgery research and practice* 2015(1): 1 – 6. Knowledge, practice and associated factors towards prevention of surgical site infection among nurses working in Amhara regional state referral hospitals, Northwest Ethiopia. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC4693022/pdf/SRP2015-736175.pdf [2019, October 2].

Tiruneh, M. A & Ayele, B. T. 2018. PLoS one 13 (8): 1 -16. Practice of code of ethics and associated factors among medical doctors in Addis Ababa, Ethiopia. [Online}. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/29555391 [02. September 2019].

Tse, A. & Schick, M. 2019. Central line placement. 1st Edition. Treasure Islands. Stat Pearls publishing LLC [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/books/NBK470286/ [2019, November 7].

Umer, A., Shapiro, DS., Hughes., Ross-Richardson, C. & Ellner, S. 2016. *Connecticut medicine* 80(4): 197- 203. The use of indwelling catheter protocol to reduce rates of post-operative urinary tract infection. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pubmed/?term=Umer+%2CShapiro%2CHughes%2C+Ross-Richardson+Ellner [2019, November 7].

van der Westhuizen, H., Nathavitharana, R., Pillay, C., Schoemann, I. & Erhlich, R. 2019. *Journal of clinical tuberculosis and other mycobacterial diseases* 17(1): 1-6. The high quality health system: Re-imagining tuberculosis infection prevention and control. [Online]. Available: https://www.sciencedirect.com/science/article/pii/S2405579419300609 [2019, October 8].

Wang, J., Liu, F., Tan, JBX., Harbarth, S., Pittet, D. & Zingg, W. 2019. *Antimicrobial resistance and infection control* 8(32):1 -16. Implementation of infection prevention and control in acute hospitals in Mainland China – a systematic review. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC6371478/pdf/13756_2019_Article_481.pdf [2019, [2019, November 5].

Ward, D. 2012. Attitude towards infection preventions and control: an interview study with nursing students and nurse mentors. *BMJ Quality and Safety,* 21(4): 301 – 306.

Ward, D. 2012. Atttitude towards the infection prevention and control nurse: an interview study. *Journal of Nursing Management,* 20 (5): 648 – 658.

White, K. M., Jimmieson, N.L., Obst, P. L., Graves., N., Barnett, A., Cockshaw, W., Gee, P., Haneman, L., Page, K., Campbell, M., Martin , E. & Paterson, D. 2015. *BMC health service research* 15 (59): 1 – 9: Using a theory of palnned behaviour framework to explore hand hygiene beliefs at the 'critical moments" among Australian hospital based nurses. [Online]. Available: https://bmchealthservres.biomedcentral.com/track/pdf/10.1186/s12913-015-0718-2 [07. November 2019].

WHO. 2010. Health care-associated infections fact sheet. [Online].Available: http://www.who.int/gpsc/country_work/gpsc ccisc fact sheet. [2010, April 01].

WHO report on the burden of endemic healthcare associated infections world-wide. 2016. [Online]. Available: https://apps.who.int/iris/bitstream/handle/10665/80135/9789241501507_eng.pdf;sequence=1 [2019, August 6].

Wistrand, C., Soderquist, B., Falk-Brynhildsen,. & Nilsson, U. 2018. *BMC infectious diseases* 18(466): 1 – 8. Exploring bacterial growth and re-colonisation after pre-operative hand disinfection and surgery between operating room nurses and non-healthcare workers. [Online]. Available: https://www-ncbi-nlm-nih-gov.ez.sun.ac.za/pmc/articles/PMC6142708/pdf/12879_2018_Article_3375.pdf [2019, November 8].

Yamakawa, K., Takasi, O., Fukuyama, M., Kitayama, J., Matsuda, H., Nakamori, Y., Fujimi, S., Ogura, h., Kuwagata, Y., Hamasaki, T. & Shimazu, T. 2011.*BMC infectious diseases*. 12(170). Assessment of risk factors related to healthcare associated MRSA infection at patient admission to an ICU in Japan [Online]. Available: http://www.ncbi.nlb.nih.gov/nlmcatalogue/journal [2015, April 8].

Yohannes, T., Kassa, G., Laelago, T. & Guracha, E. 2019. *Epidemiological international journal* 3: 000117. Healthcare workers compliance with infection prevention guidelines and associated factors in Hadiya Zone, Ethiopia. [Online]. Available: https://scholar.google.com/ [2019, November 4].

APPENDICES

A. HEALTH RESEARCH ETHICAL APPROVAL

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

Approved

New Application

Health Research Ethics Committee (HREC)

21/11/2017

Project Reference #: 0947

HREC Reference #: S17/08/152

Title: A study of nurses' knowledge, attittude and practices of infection prevention and control at a private hospital in Namibia

Dear Mrs KAVERUA Shitemo

The **New Application** received on 18/11/2017 21:32**Health Research Ethics** via **expedited** review procedures on 21 November 2017 and was approved.

Please note the following information about your approved research protocol:

Protocol Approval Period: **This project has approval for 12 months from the date of this letter.**

Please remember to use your project reference **number (947)** on any documents or correspondence with the HREC concerning your research protocol.

Please note that this decision will be ratified at the next HREC full committee meeting. HREC reserves the right to suspend the approval and to request changes or clarifications from applicants. The coordinator will notify the applicant (and if applicable, the supervisor) of the changes or suspension within 1 day of receiving the notice of suspension from HREC. HREC has the prerogative and authority to ask further questions, seek additional information, require further modifications, or monitor the conduct of your research and the consent process.

After Ethical Review

Please note you can submit your progress report through the online ethics application process, available at: https://apply.ethics.sun.ac.za and the application should be submitted to the Committee before the year has expired. Please see Forms and Instructions on our HREC website for guidance on how to submit a progress report.

The Committee will then consider the continuation of the project for a further year (if necessary). Annually a number of projects may be selected randomly for an external audit.

Translation of the consent document(s) to the language(s) applicable to your study participants should now be submitted to the HREC.

Provincial and City of Cape Town Approval

Please note that for research at a primary or secondary healthcare facility, permission must still be obtained from the relevant authorities (Western Cape Department of Health and/or City Health) to conduct the research as stated in the protocol. Please consult the Western Cape Government website for access to the online Health Research Approval Process, see: https://www.westerncape.gov.za/general-publication/health-research-approval-process. Research that will be conducted at any tertiary academic institution requires approval from the relevant hospital manager. Ethics approval is required BEFORE approval can be obtained from these health authorities.

We wish you the best as you conduct your research.

For standard HREC forms and instructions, please visit: Forms and Instructions on our HREC website (www.sun.ac.za/healthresearchethics)

If you have any questions or need further assistance, please contact the HREC office at 021 938 9677.

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B. PERMISSION FROM INSTITUTION

[redacted]

MEDICLINIC

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20 December 2017

Mrs KC Shitemo
PO Box 40714
Ausspanplatz
Windhoek
NAMIBIA

Dear Mrs Shitemo

PERMISSION TO CONDUCT RESEARCH AT [redacted]

Your research proposal entitled "*A study of nurses' knowledge, attitude and practices of infection prevention and control at a private hospital in Namibia* " refers.

It is in order for you to conduct your research at [redacted], and I wish you success with this project.

Yours sincerely

Estelle Coustas

DR ESTELLE COUSTAS
Nursing Executive

MEDICLINIC (PTY) LTD
REG. NO. 1969/009218/07

C. PARTICIPANT INFORMATION LEAFLET AND CONSENT FORM

TITLE OF THE RESEARCH PROJECT: A STUDY OF NURSES' KNOWLEDGE, ATTITUDE AND PRACTICES OF INFECTION PREVENTION AND CONTROL (IPC) AT A PRIVATE HOSPITAL IN WINDHOEK, NAMIBIA.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: CHRISTINA KAVERUA SHITEMO

ADDRESS: ERF 3976 HANEKAM STREET KHOMASDAL, WINDHOEK, NAMIBIA

CONTACT NUMBER: +264812784783(cell) +26461211748 (H)

You are being invited to take part in a research project. Please take some time to read the information presented here, which will explain the details of this project. Please ask the fieldworker any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Health Research Ethics Committee at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the international Declaration of Helsinki, South African Guidelines for Good Clinical Practice and the Medical Research Council (MRC) Ethical Guidelines for Research.

What is this research study all about?

There is a high number of healthcare associated infection HCAIs) in this hospital. In order to reduce this, the effectiveness of the infection Prevention and Control (IPC) program depends on the extent to which is it complied with. The study aims to gain a comprehensive view on the nurses' level of knowledge of, atttutide toward and their compliance with the Infection Prevention and Control (IPC) practices of the hospital.

The research study will be conducted in Windhoek Mediclinic private hospital. In will involve all categories of nurses as well as care workers. The desired total number of participants is 106. This would be 53 registered nurses, 38 enrolled nurses, 4 enrolled nurse assistants and 11 care worker. This numbers are based on their percentage in the total number of nursing personnel in the hospital.

The names of all the nurses and care workers will be divided into different ground according to their categories, after which the names of the participants will at random until the desired number is reached.

Why have you been invited to participate?

After the names were divided into the different groups, your name was randomly selected from your category. Therefore, you are invited to participate in this study.

What will your responsibilities be?

Your responsibility will be to make sure you clearly understand what this study is about and then to answer all the questions honestly. If there is something you don't understand or is not clear, feel free to ask the fieldworker or researcher whose number is given above.

Will you benefit from taking part in this research?

This study is voluntary and you will not be paid to participate. However, the information obtained from the study may help to ensure a reduction or elimination of healthcare associated infections. Which not only affects patients but healthcare workers as well.

Are there in risks involved in your taking part in this research?

There are no foreseeable risks associated with this study. However, should you feel a need for debriefing, the researcher and the occupational health nurse will be available to assist you in that regard.

Who will have access to your research data?

The information collected will be treated as confidential. The data will be published in a thesis, however your identity will remain anonymous. The questionnaire are numbered, therefore you are **NOT** required to write your name on it.
Only the researcher, the fieldworker and research supervisor will have access to the information.

Is there anything else that you should know or do?

You can contact the Health Research Ethics Committee at +277 21-938 9207 if you have any concerns or complaints that have not been adequately addressed by the fieldworker and the researcher.

You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I …….…… agree to take part in a research study entitled ***Nurses' knowledge, attitude and compliance with infection prevention and control (IPC) at a private hospital in Windhoek.***

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.

Signed at (*place*) .....…….. On (*date*) ……..…….. 2005.

....
Signature of participant **Signature of witness**

Declaration by investigator

I *(name)* ……..…… declare that:

- I explained the information in this document to ……..
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use an interpreter. (*If an interpreter is used then the interpreter must sign the declaration below.*

Signed at (*place*) .....…….. On (*date*) ……..…….. 2005.

....
Signature of investigator **Signature of witness**

D. PERMISSION FROM THE AUTHOR OF THE QUESTIONNAIRE

Christina Shitemo <cshitemo@gmail.com> 10/26/16

to p.paudyal

Good day Dr Paudyal

I trust this email finds you in good health. My name is Christina. A masters in nursing student from Namibia. I am conducting my study on Nurses' knowledge, attitude and compliance with IPC practices. I got an instrument for a related study for Julie Bruce, and she informed me that you were the original Author.

I would like to use the instrument for me study, thus I need your permission in that regard.

Kindest Regards

Christina Shitemo

Reply Forward

Priya Paudyal <P.Paudyal@bsms.ac.uk> 10/26/16

to me

Dear Christina,
Please find attached the questionnaire. I would be grateful if you could please acknowledge us in your paper.
Best Wishes,
Priya

From: Christina Shitemo [mailto: cshitemo@gmail.com]
Sent: 26 October 2016 08:43
To: Priya Paudyal <P.Paudyal@bsms.ac.uk>
Subject: Request for research instrument

This email has been scanned by MessageLabs' Email Security System

on behalf of the Brighton & Sussex Medical School. For more information see:
https://staff.brighton.ac.uk/is/computing/Pages/Email/spam.aspx

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This email has been scanned by MessageLabs' Email Security System

Christina Shitemo <cshitemo@gmail.com> 10/26/16

to p.paudyal

Dear Dr Paudyal,

Questionaire received. thank you very much. I will be sure to acknowledge you all.
do I have your permission to adapt the instrument to suit my research population?

Regards

Christina

Reply Forward

Priya Paudyal <P.Paudyal@bsms.ac.uk> 10/26/16

to me

Yes, please feel free to use it.
Best Wishes,
priya

From: Christina Shitemo [mailto:cshitemo@gmail.com]
Sent: 26 October 2016 08:54
To: Priya Paudyal <P.Paudyal@bsms.ac.uk>
Subject: Re: Request for research instrument

E. QUESTIONNAIRE

ID _____

A study of nurses' knowledge, attitude and practices with infection prevention and control practices at a private hospital in Namibia

I am conducting a survey amongst nursing personnel to ask questions related to the infection control programme in the hospital. It will be greatly appreciated if you could take a few minutes to fill out the questionnaire. It will take approximately 20 minutes to complete.
Results are anonymous, confidential and for study purpose only. PLEASE provide you honest answer.

Instruction: Please answer ALL the questions which apply to you with a cross (X)

SECTION 1: DEMOGRAPHIC DATA

#	Variable	Item	Choice
1.1	Your current age:	1.1.1. 18 – 24 years old	
		1.1.2. 25 – 29 years old	
		1.1.3. 30 – 34 years old	
		1.1.4. 35 – 39 years old	
		1.1.5. 40 – 44 years old	
		1.1.6. 45 – 49 years old	
		1.1.7. 50 years and above	
1.3	Highest Qualification: *(Please tick only one box)*	1.3.1 Grade 12	
		1.3.2. Certificate	
		1.3.3. Nursing Diploma	
		1.3.4 Bachelor in Nursing	
		1.3.5 Masters in Nursing	
1.2	Nursing category *(Please tick only one box)*	1.2.1. Unit manager	
		1.2.2.Senior registered nurse	
		1.2.3. Registered nurse	
		1.2.4 Enrolled nurse	
		1.2.5 Auxiliary nurse	
1.4	Working ward or department e.g. Surgery, Gynaecology	1.4.1. Emergency	
		1.4.2 Obstetrics/Maternity	
		1.4.3. Medical	
		1.4.4. Paediatric unit	
		1.4.5. Surgical	
		1.4.6.Neonatal ICU or Neonatal High care	
		1.4.7 Operating Room	
		1.4.8 Adult ICU	

1.5	How long have you been working as a nurse?	…… years …… months	
1.6	Have you ever attended any training on Hospital Infection prevention and control?	1.6.1. Yes	
		1.6.2. No	
		1.6.3. Don't know	
1.7	Gender	1.7.1 Male	
		1.7.2 Female	

SECTION 2: INFECTION PREVENTION AND CONTROL KNOWLEDGE

each of the following statements, please tick only one box indicating whether you ***strongly agree, agree, uncertain, disagree or strongly disagree.***

	Statement	Strongly Agree	Agree	Uncertai	Disagree	Strongly Disagree
2.1	Healthcare-acquired infections are caused by micro-organisms that can be transmitted between patients by healthcare workers					
2.2	Healthcare workers are also at risk of getting a healthcare-associated infection					
2.3	Compliance with infection control programmes can prevent the Healthcare-associated infection					

2.4	Healthcare workers can sterilize their hands by washing them					
2.5	Invasive devices, such as urinary catheterization, can increase the risk of hospital infection					
2.6	A patient in a critical clinical condition have a higher risk of acquiring healthcare infections					
2.7	Central venous catheters (CVP) should be changed after seven (7) days if necessary					
2.8	Hands should be washed before and after examining the patient					
2.9	Gloves should always be used when coming in contact with patients					
2.10	Hands should only be washed when they are visibly soiled					
2.11	Gloves should be changed between patients					
2.12	The use of gloves, mask and apron reduces the risk of infection					
2.13	The patient's urinary catheter bag should always hang lower than the patient's hip					
2.14	All patients undergoing a surgical procedure should have at least 3 (three) chlorhexidine baths pre- operatively					

SECTION 3. INFECTION PREVENTION AND CONTROL ATTITUDE

For each of the following statements, please tick if you ***Strongly agree***, ***Agree***, ***Uncertain***, ***Disagree*** *or* ***Strongly disagree***

#	Statement	Strongly agree	Agree	Uncertain	disagree	Strongly

3.1	The infection control programme gives healthcare workers additional work while they are already busy with the patient care					
3.2	It is necessary for health professionals to know whether a patient has an infectious disease					
3.3	Doing an aseptic procedure according to the manual takes up too much time					
3.4	Infection control procedures should only be followed when working with a patient with an infectious disease					
3.5	The fear of health professionals of being infected by an infectious patient is understandable					
3.6	Routine hand decontamination (e.g. hand washing) reduces the risk of infection in patients					
3.7	Hand decontamination between each patient protects both staff and patients					
3.8	Advice should be given to patient and visitors about prevention and transmission of hospital acquired infection					
3.9	I only follow the infection the infection control programme when my supervisor is watching me					
3.10	Infection control training is important					

SECTION 4. INFECTION PREVENTION AND CONTROL PRACTICES

For each of the following statements, please tick **Always**, **Regularly**, **Sometimes**, **Rarely** or **Never**

#	Statement	Always	Regularly	Sometimes	Rarely	Never

4.1	I wash perform hand hygiene each time before and after every time I come into contact with a patient					
4.2	I decontaminate my hand each time I come in contact with the patient's environment					
4.3	I wear gloves whenever there is possibility of exposure to blood or other body fluids					
4.4	I wash my hands after removing disposable gloves					
4.5	I wear a waterproof apron whenever there is possibility of blood or other body fluids splashing on my clothes					
4.6	I wear a mask on my face whenever there is possibility of blood or other body fluid splashing					
4.7	I wear a clean washed uniform every day					
4.8	I dispose of all medical waste into a red disposal bag					
4.9	I immediately wipe up all spills of blood and any other body fluids					
4.10	I cover my broken skin before coming to work					
4.11	I change my usual care if the patient has infectious disease					
4.12	I wear gloves each time when I am required to					
4.13	I protect myself against the blood and body fluids of all patients, regardless of their diagnosis					
4.14	I put used needles and other sharp objects into the designated sharp container					

4.15	I recap used needles					

Thank you for your time and cooperation in completing the questionnaire.

For any questions related to this study, please don't hesitate to contact me or my supervisor on the numbers below.

Researcher's name and contact details

Mrs Christina Shitemo

Tel: +264812784783

Email: cshitemo@gmail.com

Supervisor's contact details

Mrs Dawn Hector

Tel: +27721 938 9634

Email: hectord@sun.ac.za

F. Declaration of language editor and technical formator

MARLEO'S COMMUNICATION SERVICES

Cc 2009/033794/23

mariemunro23@gmail.com & mun2mun@absamail.co.za

27 November 2019

Confirmation of sub-editing

A study on nurses' knowledge, attitude and practices of infection prevention and control at a private hospital in Namibia

I, Leonie Munro of MarLeo's Communication Services, confirm that I subedited the text of the abstract, and the chapters of the above thesis.

Kaverua Christina Shitemo is responsible for final proofreading of the document and layout/formatting of the document.

MLC Munro